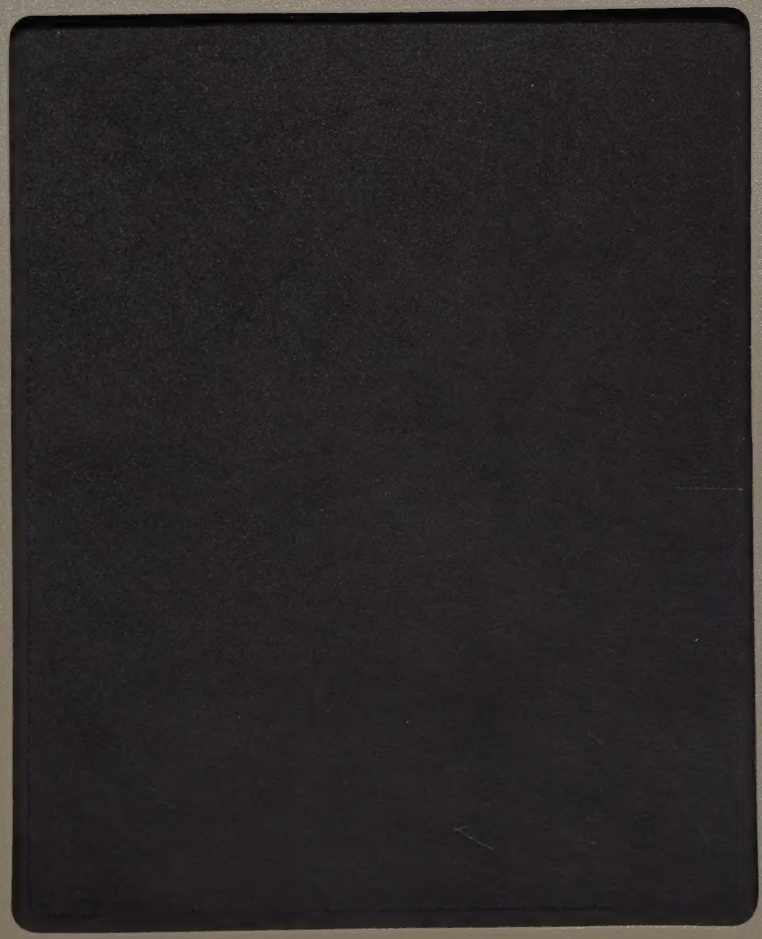
FLUKE®



8000A/BU

Digital Multimeter

Instruction Manual

P/N 471706
October 1977
Rev. 1 8/80

FLUKE®

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The JOHN FLUKE MFG. CO., INC, will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX 43210, MOUNTLAKE TERRACE, WASHINGTON 98043, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

*For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace, Washington 98043

Rev. 4/80

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8000A/BU Digital Multimeter

Section 1
Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 8000A/BU is a portable 3½-digit multimeter designed for battery or line operation. It features a total of 26 ranges, pushbutton operation, auto-polarity, auto-zero, self-locating decimal point, an analog null/peak indicator, overload protection for all ranges, and a set of rechargeable Ni-cad batteries. Several additional features are available in the form of accessories.

1-3. A series of front panel range and function pushbutton allow the selection of 26 measurement ranges; 5 ac and dc voltage, 5 ac and dc current, and 6 resistance ranges. Measurement capability within these ranges include: 100 microvolts to 1199 volts ac and dc, 100 nanoamps to 1.999 amps ac and dc, and 100 milliohms to 19.99 megohms.

1-4. The front-panel readout features a 3½-digit display using light emitting diodes (LED's). The display includes a self-locating decimal point and a + or – polarity indicator. Full-scale readout is 1999 for all ranges and functions except the 1200 volt ac and dc range, which is 1199. A blinking full-scale readout indicates that the 8000A/BU is being operated in an overrange condition.

1-5. An analog meter tracks the digital display to provide a continuous (zero to full-scale) indication of the input reading. This feature is invaluable for making peaking and nulling adjustments. The meter also provides an indication of the battery status; charged, discharged, charging.

1-6. Front panel input connectors are banana type and provide separate connections for common, current, and volt-ohm inputs. Both the current and volt-ohm inputs are referenced to the common input. Common is isolated from earth ground and can operate at a potential of up to ± 1200 volts peak with reference to earth ground.

1-7. The overload features of the 8000A/BU include a fused current input and an overvoltage protected volt-ohm input. This protection applies for any function and range selected.

1-8. Several accessories are available for use with the 8000A/BU, and are described in Table 1-1. A more detailed description of the accessories is given in Section 6 of this manual. (A80, Deluxe Test Lead Kit, and 82RF, High Frequency Probe, are included with the 8000A/BU.)

Table 1-1. 8000A/BU Accessories

ACCESSORY MODEL NO.	DESCRIPTION
Y8205	Carrying Case, Vinyl
C86	Carrying Case, Molded Plastic
M00-100-714	Front Panel Dust Cover
M00-200-611	Rack Mounting Kit, Center
M00-200-612	Rack Mounting Kit, Left/Right
M00-200-613	Rack Mounting Kit, Side-By-Side
A80	Deluxe Test Lead Kit
80T-150	Temperature Probe
80I-600	Current Transformer
80K-40	High Voltage Probe
81RF	High Frequency Probe
82RF	High Frequency Probe

1-9. Operating power for the 8000A/BU can be derived from the internal Ni-cad batteries or from line power. The batteries allow continuous portable operation for at least 8 hours on a single charge. Recharging automatically occurs when the unit is connected to line power; 115 volts, 50 to 400 Hz.

1-10. SPECIFICATIONS

1-11. Detailed specifications for the 8000A/BU are given in Table 1-2.

Table 1-2. 8000A/BU Sepcifications

DC VOLTAGE	
Ranges	±199.9 mV, ±1.999V, ±19.99V, ±199.9V, ±1199V
Accuracy (1 year, 15°C to 35°C)	±(0.1% of reading + 1 digit)
Temperature Coefficient: (−10°C to 15°C and 35°C to 55°C)	±(0.01% reading/ °C + .005% F.S.) / °C
Input Impedance	10 MΩ, all ranges
Normal Mode Rejection	Greater than 60 dB @ 50 Hz, 60 Hz
Common Mode Rejection (1 kΩ unbalance)	Greater than 120 dB @ dc and 50 Hz, 60 Hz
Response Time	0.5 seconds
Maximum Input Voltage	1200V rms, all ranges
AC VOLTAGE	
Ranges	199.9 mV, 1.999V, 19.99V, 199.9V, 1199V
Accuracy 100% to 0.05% of Range (1 year, 15°C yo 35°C)	45 Hz to 10 kHz ±(0.5% of reading + 2 digits) 10 kHz to 20 kHz ±(1% of reading + 2 digits) 20 kHz to 100 kHz ±(3% of reading + 2 digits)
With RF Probe 500 MHz to 1 GHz	100 kHz to 500 MHz ±3 dB, 30 volt max. Use for relative measurements
Temperature Coefficient (−10°C to 15°C and 35°C to 55°C)	±(0.01% reading/ °C + 0.005% F. S.)/ °C
Input Impedance	10 MΩ in parallel with 100 pF (with probe 2MΩ, 4 pF)
Common Mode Rejection (1 kΩ unbalance)	Greater than 60 dB @ 50 Hz, 60 Hz
Response Time	3 seconds, worst case
Maximum Input Voltage	1200V rms, not to exceed 10^7 volt Hz product on 20, 200, 1200V ranges. 500V rms on 200 mV and 2V ranges
DC CURRENT	
Ranges	±199.9 μA, ±1.999 mA, ±19.99 mA, ±199.9 mA, ±1999 mA
Accuracy (1 year 15°C to 35°C)	±(0.3% of reading + 1 digit)
Temperature Coefficient (−10°C to 15°C and 35°C to 55°C)	±(0.015% reading/ °C + 0.005% F. S.)/ °C
Voltage Burden	0.3V maximum up to 200 mA; 0.6V at 2 amps
Response Time	0.5 seconds
Maximum Input	2 amps rms (fuse protected)
AC CURRENT	
Ranges	199.9 μA, 1.99 mA, 19.99 mA, 199.9 mA, 1999 mA
Accuracy (1 year, 15°C to 35°C)	45 Hz to 10 kHz ±(1% of reading + 2 digits) except 2000 mA range. 45 Hz to 3 kHz ± (1% reading + 2 digits) on 2000 mA range.
Temperature Coefficient (−10°C to 15°C and 35°C to 55°C)	±(0.015% reading/ °C +0.005% F. S.)/ °C
Voltage Burden	0.3V maximum up to 200 mA; 0.6V at 2 amps
Response Time	3 seconds, worst case
Maximum Input	2 amps rms (fuse protected)

Table 1-2. 8000A/BU Specifications (Cont)

RESISTANCE

Ranges	199.9Ω, 1.999 kΩ, 19.99 kΩ, 199.9 kΩ, 1999 kΩ, 19.99 MΩ
Accuracy (1 year, 15°C to 35°C)	±(0.2% of reading + 1 digit) all ranges except ±(0.5% of reading + 1 digit) on 20 MΩ range
Temperature Coefficient: (−10°C to 15°C and 35°C to 55°C)	KΩ ±(0.015% reading/°C + 0.005% F. S.)/°C 10 Meg ±(0.02% reading/°C + 0.005% F. S.)/°C
Response Time	0.5 second, all ranges except: 4 seconds on 20 MΩ range
Current through Unknown	200Ω range, 1 mA 2 kΩ range, 1 mA 20 kΩ range, 100 μA 200 kΩ range, 1 μA 2000 kΩ range, 1 μA 20 MΩ range, 0.1 μA
Maximum Input Voltage	200Ω and 2 kΩ ranges, 130V rms 20 kΩ through 20 MΩ ranges, 250V rms

GENERAL

Protection Class 1	Relates solely to insulation or grounding properties described in IEC 348
Maximum Common Mode Voltage	1200V peak
Operating Temp. Range	−10°C to +55°C
Storage Temp. Range	−40°C to +75°C (−40°C to +60°C with batteries)
Humidity Range	0 to 80% RH
Shock and Vibration	Meets requirement of MIL-T-21200K and MIL-E-16400F
Display	7-segment LED, 0.300" character height, & analog panel meter (1" x 0.375")
Size	6.40 cm high x 21.72 cm wide x 25.15 cm deep (2.52 in x 8.55 in x 9.90 in) See Figure 1-1.
Weight	4 pounds (1.8 kilograms)
Power	115V ac, 50 to 440 Hz, 2 watts 8 hour minimum operation on internal rechargeable batteries (charge time is = 13 hours)

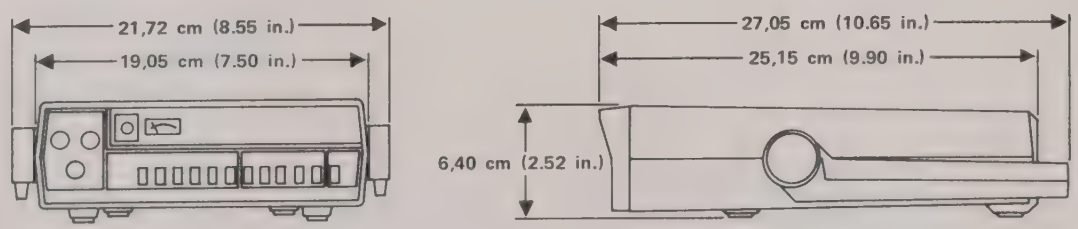
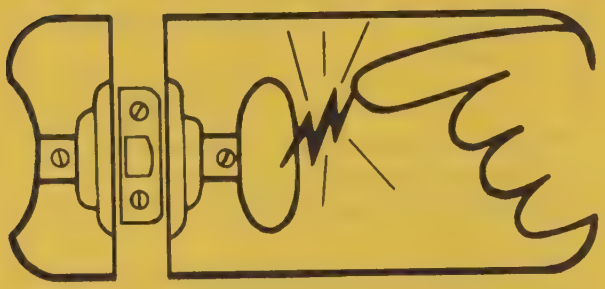


Figure 1-1. 8000A/BU Outline Drawing

static awareness

A Message From

John Fluke Mfg. Co., Inc.

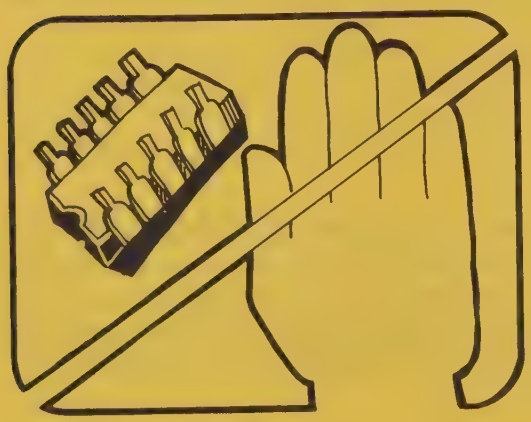


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

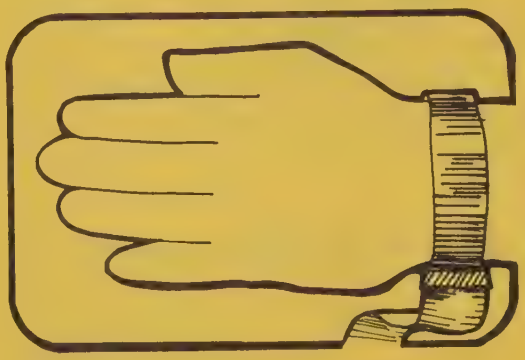
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗".

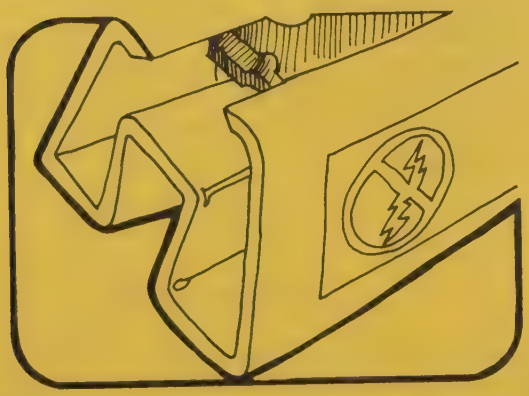
The following practices should be followed to minimize damage to S.S. devices.



1. MINIMIZE HANDLING

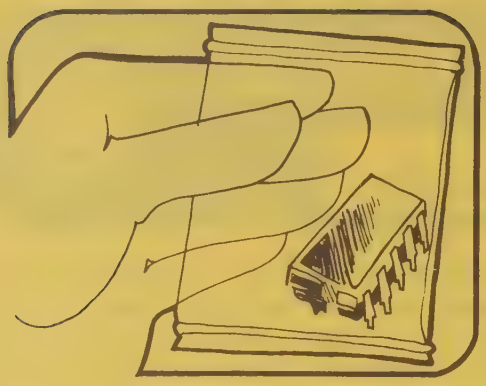


3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES

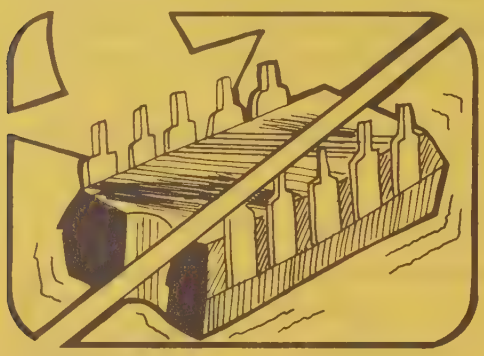


2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.

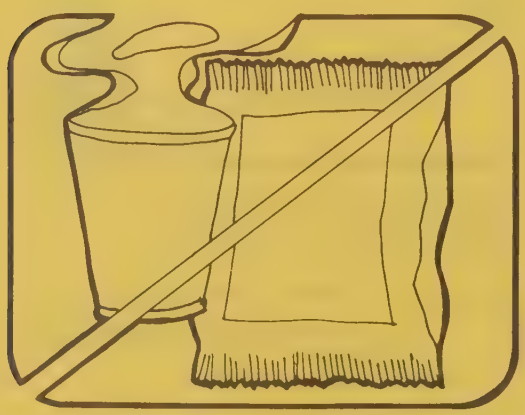
4. HANDLE S.S. DEVICES BY THE BODY



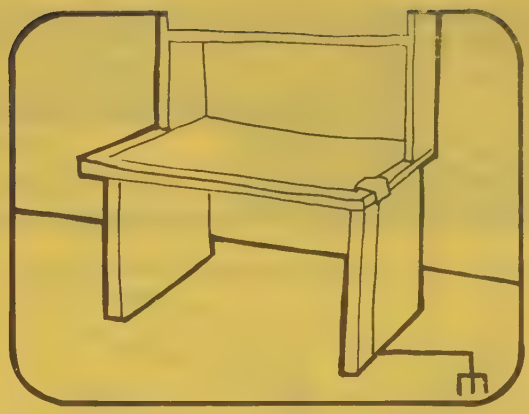
5. USE ANTI-STATIC CONTAINERS FOR HANDLING AND TRANSPORT



6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM IN WORK AREA



8. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION

9. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.

10. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

Anti-static bags, for storing S.S. devices or pcbs with these devices on them, can be ordered from the John Fluke Mfg. Co., Inc.. See section 5 in any Fluke technical manual for ordering instructions. Use the following part numbers when ordering these special bags.

John Fluke Part No.	Bag Size
453522	6" x 8"
453530	8" x 12"
453548	16" x 24"
454025	12" x 15"

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section of the manual contains information regarding installation and operation of the Model 8000A/BU. It is recommended that the contents of this section be read and understood before any attempt is made to operate the instrument. Should any difficulties arise during operation, please contact your nearest John Fluke Sales Representative, or the John Fluke Mfg. Co., Inc., P.O. Box 43210, Mountlake Terrace WA, 98043, Tel. (206) 774-2211. A list of Sales Representatives is located in Section 7 of this manual.

2-3. SHIPPING INFORMATION

2-4. The 8000A/BU is packaged and shipped in a foam-packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage.

2-5. If reshipment of the instrument is necessary, the original container should be used. If the original container is not available, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the instrument model number when requesting a new shipping container.

2-6. INPUT POWER

2-7. Battery Operation

2-8. A set of four Ni-cad batteries is supplied with the 8000A/BU, and provide at least 8 hours of portable operation before recharging is necessary. Normal recharging is initiated when the unit is connected to the ac power line and the POWER SWITCH is in the OFF position. If desired the unit can be operated during the charging process. However, the charging time will be increased.

2-9. Line Operation

2-10. The 8000A/BU is factory wired to operate from 115V ac, 50 to 400 Hz. Before connecting the unit to the ac line, check to insure that it is wired to accomodate the local line voltage. A decal on the underside of the 8000A/BU specifies the particular line voltage required for proper operation.

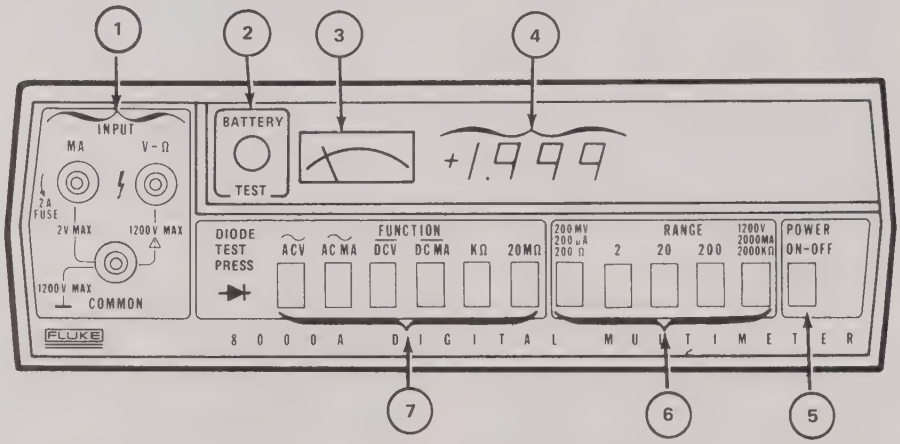
2-11. The rear-panel power-input connector is a three-prong, U-ground connector which permits the instrument to be connected, via the power cord, to the appropriate line power. The offset prong on this connector is connected to the 8000A/BU power supply, and should be connected, via the power cord, to a high quality earth ground.

2-12. RACK INSTALLATION

2-13. The 8000A/BU is designed for either field or bench-top use, or for installation in a standard 19-inch equipment rack using an optional accessory rack mounting kit. Rack mounting kits are available for left, right, center, or side-by-side mounting. Information regarding installation of the rack-mounting accessories is given in Section 6 under Rack Installation.

2-14. OPERATING FEATURES

2-15. The location of all 8000A/BU controls, indicators and connectors are shown in Figure 2-1, and described in Table 2-1.



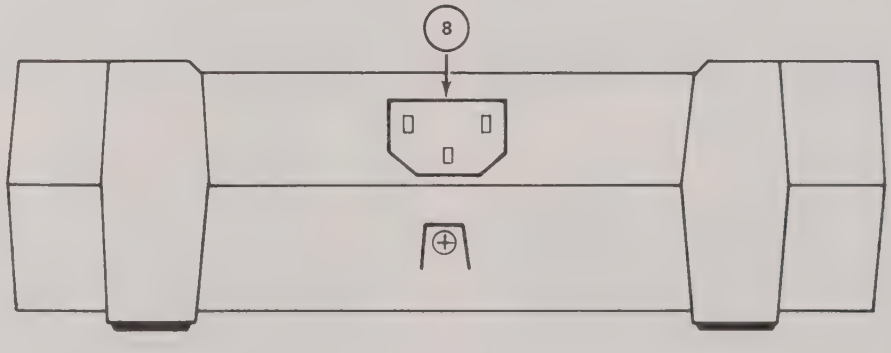


Figure 2-1. 8000A/BU Controls, Indicators and Connectors

Table 2-1. 8000A/BU Controls, Indicators and Connectors

REF. NO.	NAME	FUNCTION
1	Input Connectors	Provides the Input connections necessary to make current (MA), voltage (V), or resistance (Ω) measurements. All measurements are referenced to the COMMON INPUT connector.
2	BATTERY TEST Switch (momentary)	Switches the analog meter into operation as a battery status monitor. That is, when the unit is connected to line power and the TEST switch is pressed, the meter indicates charge (CHG). However, when the unit is disconnected from line power, it indicates the relative charge level of the batteries (5.5V = full charge, 4.0V = end-of-charge).
3	Analog Meter	Provides an analog indication of the input signal level. The full-scale meter range is the same as that indicated by the RANGE and FUNCTION switch settings. The meter is most useful for making alignments that require null or peak indications. When the BATTERY TEST switch is pressed the meter is used as a battery monitor (See BATTERY TEST Switch).
4	Digital Readout	Provides a 3½ digit display (1999 maximum) of the measured input. The readout also includes a properly positioned decimal point, and a + or − sign for dc voltage and current measurements.
5	POWER Switch	Switches the instrument on or off. The unit is turned-on when the switch is depressed.
6	RANGE Switches	Provides pushbutton select of one-of-five ranges which correspond to the selected function (current, voltage, or resistance). The available ranges are: Voltage: 200 MV, 2, 20, 200 and 1200V Current: 200 μA, 2, 20, 200 and 2000 MA Resistance: 200Ω, 2, 20, 200 and 2000 kΩ Diode Test: (2 KΩ) A 1mA current through the test leads causes the V_F of an unknown PN junction (forward biased diode) to be displayed.
7	FUNCTION Switches	Provides pushbutton selection of one-of-six measurement functions; ACV, AC MA, DCV, DC MA, KΩ, or 20 MΩ.
8	Input Power Connector	Provides the means of connecting the instrument through the power cord to the ac power line.

2-16. OPERATING NOTES

2-17. The following paragraphs describe various conditions which should be considered before operating the 8000A/BU.

2-18. Batteries

CAUTION!

Damage may result if alkaline, zinc-carbon, or mercury batteries are charged in the 8000A/BU.

2-19. With a fully-charged battery set, the 8000A/BU can be disconnected from line power and operated for at least 8 hours, as a portable instrument. When the display digits are too dim to read, the batteries should be recharged by switching the POWER switch to OFF and connecting the instrument to the ac power line. The total charge time is approximately 13 hours. If desired, the 8000A/BU can be operated during the charging process, however, the charge time will be extended to approximately 43 hours.

NOTE

Battery manufacturers recommend that Ni-cad batteries be recharged at least every 90 days. Storage temperatures below +25°C are recommended.

2-20. There are some phenomena that should be considered when charging nickel-cadmium batteries. For instance, charging Ni-cad batteries with cell case temperatures above 25°C will decrease the charge capacity of the cell. The decrease in capacity is linear from 100% of rated capacity at 25°C to only 60% of rated capacity at 50°C, and as low as 45% at 60°C. Cell case temperatures typically run from 5°C to 10°C above ambient temperature during charging due to heat dissipated by the charging circuit.

2-21. Charging capacity may also be affected by a cell's charge-discharge routine, due to a memory-type phenomena. For instance, if a Ni-cad battery pack is used in a daily routine where it is allowed to discharge by only 30% before being fully recharged again, it will eventually become a battery pack capable of delivering only 30% of its rated capacity. To return such a battery pack to its rated capacity, connect an external load to completely discharge the battery at a rate equal to its capacity divided by 20. For example, a pack of nine series-connected 1.2 - volt cells having individual capacity ratings of 2.3 ampere hours should be discharged at 2.3 amp hrs/20 = .115 amp. This requires a load resistor of 10.8V/.115 amp = 100 ohms (approximate) with a wattage rating of at least (10.8V) (.115 amp) = 1.25W. (A 2-watt carbon composition resistor would be suitable.)

2-22. Allow the battery pack to discharge for 30 hours, then charge the battery pack at twice the discharge rate for 20 hours. (In the example, the charging rate would be 0.23 amperes at 10.8 volts.) When charging is complete, discharge the pack at the capacity - divided-by-20 rate for 30 hours, then recharge at twice the discharge rate for 20 hours. The battery pack should now be restored to its rated capacity.

2-23. Fuses

2-24. The 8000A/BU is equipped with a line power fuse, and a current overload fuse for the current measuring function. Refer to Section 4 of this manual for line power fuse replacement information. The current overload fuse is located behind the front-panel MA INPUT terminal, and is accessed by turning (ccw) and removing the MA INPUT terminal. Use a 2 amp AGX replacement fuse.

2-25. Overrange Indication

2-26. The front panel display, in addition to providing a measurement reading, is designed to serve as an overrange indicator. When the full scale capability of the selected range for any function is exceeded, the display will blink while indicating a full scale reading. The presence of an overrange indication does not necessarily mean that the instrument is being exposed to a damaging input condition.

2-27. Input Overload Protection ⚠

CAUTION

Exceeding the maximum input overload conditions can damage the 8000A/BU. Read Tables 2-2 and 2-3 before attempting to operate the instrument.

WARNING

INSTRUMENT DAMAGE AND OPERATOR INJURY MAY RESULT IF THE FUSE BLOWS WHILE CURRENT IS BEING MEASURED IN A CIRCUIT WHICH EXHIBITS AN OPEN CIRCUIT VOLTAGE >250 VOLTS. TO PREVENT THIS POSSIBILITY, PLACE A SUITABLE MOUNTED AND INSULATED 1.5A FUSE OF THE PROPER VOLTAGE RATING (>250V) IN SERIES WITH THE HIGH (mA) INPUT LEAD.

2-28. Each range and function of the 8000A/BU is equipped with input overload protection. The maximum allowable input overload conditions for each function and range are given in Table 2-2.

2-29. OPERATION

2-30. Use the following procedure for initial turn-on of the 8000A/BU:

1. Connect the instrument to operating power. (See Paragraph 2-6)

2. Depress the POWER switch.

3. In accordance with Table 2-3, select the desired function and range; connect the test leads to the corresponding input connectors.

Table 2-2. 8000A/BU Maximum Allowable Input Overload Conditions

SELECTED FUNCTION	SELECTED RANGE	MEASUREMENT INPUT CONNECTIONS	MAXIMUM INPUT OVERLOAD LIMITS
DC V	200 MV, 2, 20, 200, or 1200V	V-Ω and COMMON	1200V DC or 1200V rms (sinusoidal)
DC MA	200 μA, 2, 20, 200, or 200 MA	MA and COMMON	2A [1]
AC V	20, 200 or 1200V	V-Ω and COMMON	1200V rms (sinusoidal); 500V rms (sinusoidal); Volt-Hertz product not to exceed 10^7
	200 MV or 2V	V-Ω and COMMON	500V rms (sinusoidal)
AC MA	200 μA, 2, 20, 200 or 2000 MA	MA and COMMON	2A [1]
KΩ	200Ω or 2	V-Ω and COMMON	130V rms
	20, 200 or 2000 KΩ	V-Ω and COMMON	250V rms
20 MΩ	Not Applicable	V-Ω and COMMON	250V rms
Any	Any	Earth Ground and COMMON	1200V peak

[1] Fuse protected in circuits with open circuit voltage ≤250V dc/rms ac. Do not use above 250V.

Table 2-3. 8000A/BU Measurement Instructions

DESIRED MEASUREMENT	SELECT FUNCTION	SELECT RANGE	MEASUREMENT INPUT CONNECTIONS
DC Volts	DC V	200 MV, 2, 20, 200 or 1200V	V-Ω and COMMON
DC Milliamperes	DC MA	200 μA, 2, 20, 200 or 2000 MA	MA and COMMON
AC Volts	AC V	200 MV, 2, 20, 200 or 1200V	V-Ω and COMMON
AC Milliamperes	AC MA	200 μA, 2, 20, 200 or 2000 MA	MA and COMMON
Kilohms	KΩ	200Ω, 2, 20, 200 or 2000 KΩ	V-Ω and COMMON
Megohms	20 MΩ	Not Applicable	V-Ω and COMMON

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. This section of the manual contains a simplified block diagram analysis followed by circuit description of the Model 8000A/BU. Simplified diagrams are included, as necessary, to supplement the text. Schematic diagrams are included in Section 8 of this manual.

3-3. SIMPLIFIED BLOCK DIAGRAM ANALYSIS

3-4. Introduction

3-5. The 8000A/BU, as shown in the simplified block diagram of Figure 3-1, can be divided into three major sections; the Input Signal Conditioner, the Analog-to-Digital (A/D) Converter, and the Front Panel Display. Each section is discussed separately in the following paragraphs.

3-6. Input Signal Conditioner

3-7. The function of the Input Signal Conditioner is to condition the applied input, according to the selected function, and to provide a scaled dc output voltage which is proportional to the applied input. The output voltage will be from 0 to ±0.2V dc, or 0 to ±2.0V dc depending on range selected. The RANGE switches, located in the Input Divider and Current Shunt circuits, scale the input signal to a level which is acceptable for the selected function. The FUNCTION switches place the Signal Conditioner in the configuration necessary to process the input signal.

3-8. A/D Converter

3-9. The A/D Converter changes the analog dc output voltage of the Signal Conditioner into a digital representation. This is accomplished in two stages using a voltage-to-frequency converter (Analog IC) and a digital counter/processor (Digital IC). The A/D Converter also controls the measurement and display period of the 8000A/BU.

3-10. Display

3-11. The Display section of the 8000A/BU accepts digital information from the A/D converter, and converts it into a visual, numeric presentation which corresponds to the

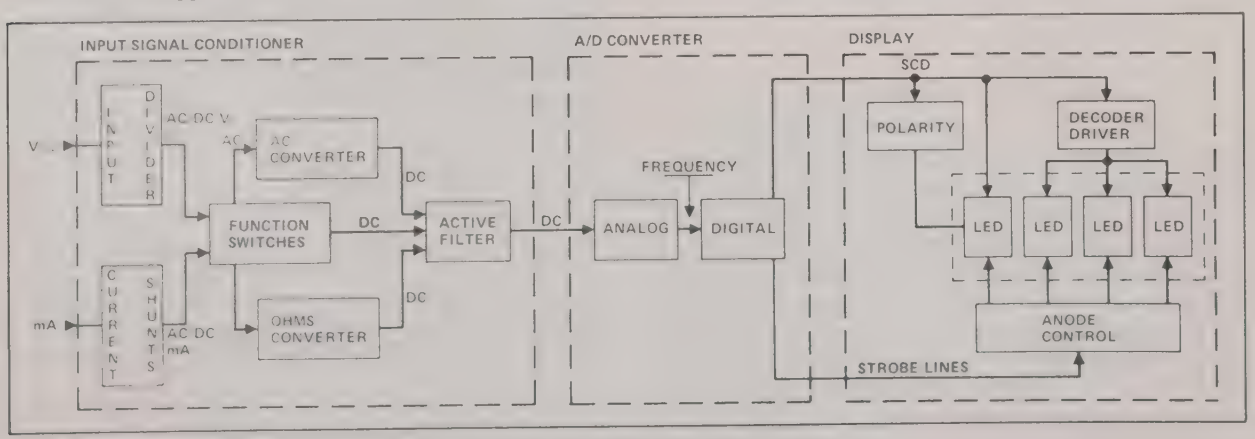


Figure 3-1. Model 8000A/BU Block Diagram

value of the applied input signal. The display is updated at a rate governed by the A/D converter.

3-12. CIRCUIT DESCRIPTION

3-13. The following circuit descriptions are keyed to the functional blocks defined in the simplified block diagram of Figure 3-1. Corresponding functional blocks are defined in the detailed schematics in Section 8. Refer to the schematics while reading the following circuit descriptions.

3-14. Signal Conditioning

3-15. INPUT VOLTAGE DIVIDER

3-16. Three series connected resistors (R1, R2 and R3) totaling 10 megohms are tapped to provide division ratios of 100 or 1000 to 1. The 20 and 200V ranges use the 100:1 tap, and the 1200V range uses the 1000:1 tap.

3-17. Trimming capacitors are connected across the Input Voltage Divider to maintain a flat frequency response when used for ac voltages. High frequency compensation during calibration can be accomplished with variable trimmer capacitor C3.

3-18. CURRENT SHUNTS

3-19. The current shunts consist of resistors R44 through R48. Series-connected resistors R44 through R47 are switched into the circuit, depending upon the RANGE selected. The resistor steps are 1000, 100, 10, and 1 ohms for the 0.2, 2, 20, and 200 milliampere ranges, respectively. A separate 100 milliohm four terminal shunt is used for the 2000 MA range.

3-20. The maximum voltage developed across a single shunt or combination of shunts for full range indication is 0.2 volts. Current overload protection above 2 amperes is provided by fuse F2. The shunts are protected against overvoltage by diodes CR9 through CR12.

3-21. AC CONVERTER

3-22. The ac converter, shown in Figure 3-2, is an RMS calibrated (sinewave) average converter. U1 is an FET input operational amplifier which buffers the input signal. U1 then applies a current corresponding to this input to CR1 and CR2 on alternate half cycles. On positive half cycles, CR2 conducts and a voltage is applied across scaling resistors R1 and R2. These resistors form a feedback divider for U1, which then sets the calibration of the converter. On negative half cycles, CR1 conducts, the current bypasses R1, and a half-wave rectified signal appears across R1. The rectified voltage is filtered by R3 and C1 before being supplied to the A/D converter.

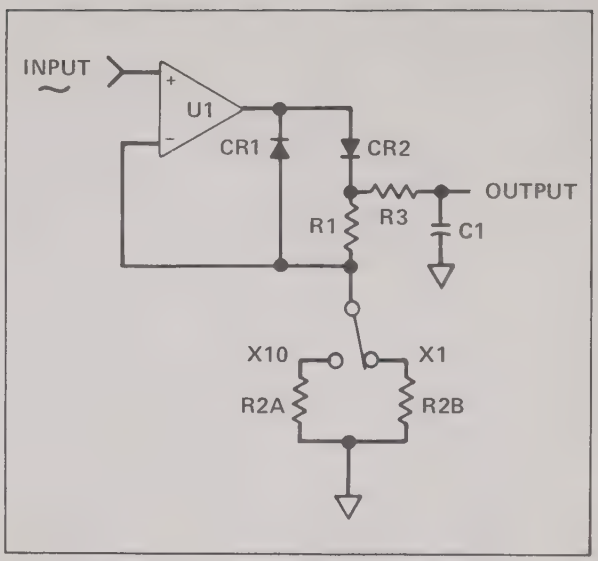


Figure 3-2. AC Converter Simplified Diagram

3-23. The converter is designed to accept two ranges of input voltages: 200mV and 2V. This allows for two ac voltage ranges to share one tap on the input divider. Ranging is accomplished by switching between R2A and R2B where R2B is 10 times the value of R2A.

3-24 OHMS CONVERTER

3-25. The Ohms Converter supplies a dc voltage, proportional to the unknown resistance (R_X), to the A/D Converter. A simplified diagram of the circuit elements involved is illustrated in Figure 3-3. Operational Amplifier U2 bootstraps the current source. With the non-inverting input connected to the junction of R_A and R_X, current will flow through R_A and R_X such that a constant voltage is maintained across R_A for a given RANGE. If R_X is within the range selected, the voltage developed will be proportional to the value of R_X. For resistance ranges 200 ohms through 2000 kilohms, the constant voltage maintained is 10 volts. In the 20 megohm range, U2's feedback resistor, R_F, is changed so that a 1 volt potential is maintained.

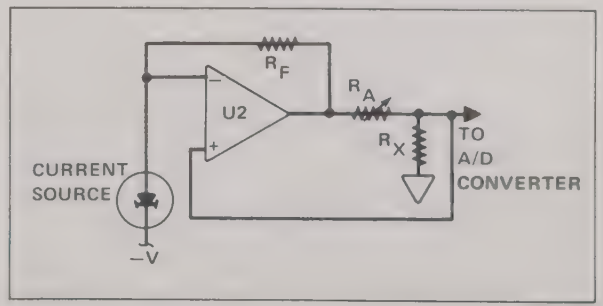


Figure 3-3. Ohms Converter Simplified Diagram

3-26. ACTIVE FILTER

3-27. The active Filter ensures that the input to the A/D Converter receives only dc voltages. The operational amplifier (U2) used for the Ohms Converter is also used in conjunction with R18, C11, R19, and C12 to form a two-pole Bessel-type active filter (see Figure 3-4). A cutoff frequency of 10 Hz and a 60 Hz rejection ratio of 32 db is provided by this filter. Normal mode rejection at frequencies other than even multiples of the integration period is also provided. Overloading of the A/D Converter by large ripple voltages is prevented by the filter.

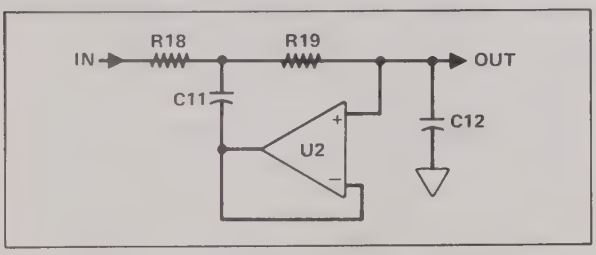


Figure 3-4. Active Filter Simplified Diagram

3-28. Analog-to-Digital Converter

3-29. GENERAL

3-30. The A/D Converter uses a voltage-to-frequency conversion technique. A dc voltage at the input of the A/D Converter is changed to a frequency by the Analog Integrated Circuit. This frequency is directly related to the magnitude and polarity of the dc input voltage. Counting of the output frequency from the Analog IC is accomplished by the Digital IC. The resultant count is transferred (in binary coded decimal format) to the display section.

3-31. ANALOG IC

3-32. The Analog IC is an LSI device which contains a two-input multiplexer, an amplifier, and a voltage controlled oscillator (VCO). In operation, the Analog IC samples between a reference voltage (0 V dc) and the output of the Active Filter (0 to ± .2 or 0 to ± 2V dc) to provide two separate output frequencies. The difference between the two frequencies is an accurage digital representation of the input voltage. This A/D conversion technique automatically eliminates the zero-offset errors which are inherent in many A/D converters. For example, if the VCO rest frequency is ≈ 40 kHz during the reference sample and a 0V dc input is present during the voltage sample, the output of the VCO does not change. No change is equal to 0V dc. Therefore, as long as the oscillator does not drift during the two sample periods a zero-offset error cannot exist.

3-33. The range resistor, in Figure 3-5, symbolizes the dual range capability of the Analog IC. This resistance, external to the IC, consists of series resistors R23, R57, R25 and R58. When the instrument is in the 2 volt basic range, all four resistors are used to scale the current to the V/F Converter. Variable resistor R25 is the calibration adjustment for this range. For operation in the 0.2 volt basic range, the switching provides a short across R25 and R58. Therefore, only resistor R57 and calibration adjustment R23 scale the current to the proper level for the V/F Converter.

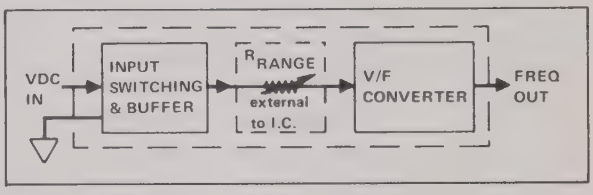


Figure 3-5. Analog IC Block Diagram

3-34. Timing circuitry for the A/D Converter is contained in the Analog IC. The connection between the Analog IC and the Digital IC is through R41, Q6, R56, and adjustment R20. Overload protection for the Analog IC is provided by transistors Q20 and Q21. Negative overload voltages are handled by Q20 and positive overloads by Q21.

3-35. DIGITAL IC

3-36. The output from the Analog IC alternates between the rest frequency during one time period, and a frequency corresponding to the A/D Converter input voltage during the next time period. Reversible counters in the Digital IC count these frequencies such that their difference is used to provide the bcd measurement information.

3-37. A four-line bcd output (W-X-Y-Z on schematic) and a four-line strobing pulse output (S1-S2-S3-S4 on schematic) are provided by the Digital IC to the Display section. The bcd lines W-X-Y-Z correspond to binary 8-4-2-1 positions, respectively.

3-38. Display

3-39. POLARITY

3-40. The polarity indicator consists of horizontal and vertical LED segments of DS1. These segments are strobed during the S1 time period, when the instrument is in the DCV or DC MA function. The horizontal segment is used alone for a negative indication, and together with the vertical segment to build a positive indication. Consequently, the horizontal segment must illuminate during each S1 time period. This is accomplished by S3D (DCV) or S4C (DC MA) which ground the cathodes of the horizontal LED segment. Illumination of the vertical segment relies upon the digital information provided by the Y bcd line during S1 time. When a positive voltage or current is applied to the INPUT terminals, the Y line goes high. This turns on

Q8 and Q10 which allow the vertical segment to illuminate. With the Y line low Q8 and Q10 are cut off and the vertical segment does not illuminate.

3-41. DECODER DRIVER

3-42. The Decoder Driver, U5, translates the bcd information on the W-X-Y-Z lines for application to the LED readouts DS2, DS3, and DS4. Low inputs are provided by the Decoder Driver through a resistor network U7 to the LED segments for construction of decimal numbers.

3-43. DECIMAL POINT

3-44. The LED readouts DS2, DS3, and DS4 contain a decimal point which is controlled by the RANGE switches. The selected range causes the resistor network U6 to supply a negative voltage to the cathode of the decimal segment. Note on the schematic that the 20MΩ FUNCTION, which requires no range selection, shares the 20 RANGE decimal point of DS2.

3-45. ANODE CONTROL

3-46. The Anode Control circuit, Q11 through Q18 applies +5V dc to the anodes of the LED readouts. Strobe pulses from the Digital IC determine which readout receives the proper anode voltage at a particular time. The strobe pulse sequence is S1-S3-S2-S4, yielding a display sequence of DS1-DS3-DS2-DS4. For example: when S2 goes high, Q12 and Q16 turn on and apply approximately +5V dc to the anodes of the LED segments on DS2. Those segments with negative voltages on their cathodes, at S2 time, will illuminate and form a decimal number.

3-47. LED READOUTS

3-48. The LED readouts DS2, DS3, and DS4 each contain 7½ diode segments. One-half of a segment for a decimal point and seven segments to form decimal numbers. The segments are designated A through G for each readout on the schematic.

3-49. Readout DS1 indicates the most significant digit (MSD) and polarity. Two segments form a numerical "1" and two segments to form the polarity signs. Control of the MSD "1" indication is separate from the other readouts. The bcd information is produced on the Z line during the S1 time period. When line Z is high during time S1, Q7 and Q9 turn on to allow the "1" segment to illuminate.

3-50 Analog Meter

3-51 The analog meter section of the 8000A/BU, as shown in Figure 3-6, is designed to provide an analog indication of the input signal level for use in alignment applications (signal null and peaking). A BATTERY TEST switch allows the meter to perform the alternate function of indicating relative battery charge.

3-52. Functionally, the circuit consists of an analog meter, an active full-wave rectifier to drive the meter, a low-pass RC filter, and an analog switch. Analog data is received as a - 0.2 to + 0.2 V dc signal from the analog IC U3, and is sampled and held by the low-pass filter during the Read portion of the a/d conversion cycle. During the Zero portion (100 ms) of the conversion cycle, the analog switch disconnects the analog input from the filter input, allowing the sampled data to be held. Data retained by the filter is

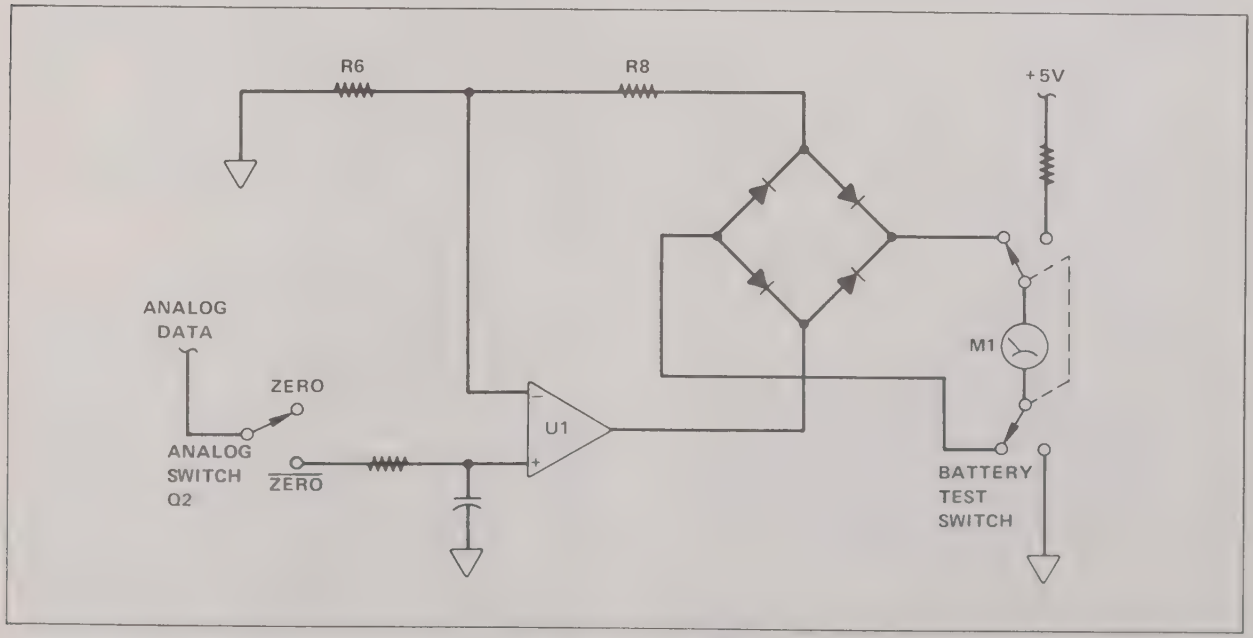


Figure 3-6. Meter Circuit Diagram

used to directly drive the non-inverting input of the active rectifier (formed by op amp U1). A full-wave bridge incorporated in the feedback loop of the active rectifier directs current flow through the meter to ensure that voltage variations above and below 0V dc appear as a voltage increase on the meter.

3-53. When the BATTERY TEST switch is depressed, the meter is disconnected from the active rectifier and connected in series with a scaling resistor to the +5V dc power supply and logic common. During battery operation the meter indicates the relative charge level of the batteries; 5.5 V dc - full charge, 4.0V dc - end of charge. During line operation the meter indicates charge (CHG) when the BATTERY TEST switch is pressed.

3-54. Power Supply

3-55. The 8000A/BU uses the battery operated power supply. With the POWER switch ON, the batteries are connected to the input of a dc-to-dc converter which consists of Q22, Q23, T2, CR15 through CR18, C17 and C18. Transistors Q22 and Q23, and transformer T2 form a 5 kHz multivibrator whose output signal is coupled by T2 to the diode rectifiers CR15 through CR18. Capacitors C17 and C18 filter the rectified voltage to supply the $\pm$ 15V dc outputs. The unregulated +5V dc is supplied by the battery.

3-56. The battery is charged whenever the instrument is connected to ac line power. Transformer T1, CR13, and CR14 provide the rectified charging voltage. Lamp, D5, in parallel with R21 acts as a dynamic current control which limits the charging current to approximately 450 mA. With the instrument connected to line power and the POWER switch OFF, approximately 425 mA can be supplied to a discharged battery.

Section 4
Maintenance

WARNING
THESE SERVICING INSTRUCTIONS ARE FOR USE BY QUALIFIED PERSONNEL ONLY. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO.

4-1. INTRODUCTION

4-2. This section of the manual contains maintenance information for the Model 8000A/BU DMM. This includes service information, general maintenance, performance test, calibration, and troubleshooting. The performance test is recommended as a preventative maintenance tool, and should be executed when it is necessary to verify proper instrument operation. The 8000A/BU should be calibrated annually to ensure it is within the one-year specifications. Troubleshooting information is given in the form of flow charts at the end of this section. Table 4-1 lists the recommended test equipment necessary to maintain the 8000A/BU. If the specified equipment is not available, other equipment having equivalent specifications may be used.

4-3. The Model 8000A/BU DMM is warranted for a period of one year upon delivery to the original purchaser. The WARRANTY is given on the back of the title page located in the front of this manual. For the WARRANTY to become effective, the validation card included with the instruction manual must be completed and returned to the John Fluke Mfg. Co., Inc.

4-4. Should your instrument need repair, send it to the nearest authorized service center. A complete list of service centers is included in Section 7. Shipping information is given in Section 2 of this manual. If requested, an estimate will be provided to the customer before work is begun on instruments that are beyond the warranty period.

Table 4-1. Recommended Test Equipment

EQUIPMENT NOMENCLATURE	SPECIFICATIONS	RECOMMENDED EQUIPMENT
DC Voltage Source	20mV to 1100V ± 0.005%	Fluke Model 5100B
DC Current Source	199μA to 2A ± 0.025%	Fluke Model 5100B
AC Voltage Source	20mV to 1100V (50 Hz to 10 kHz) ± 0.05% 20mV to 1100V (10 kHz to 50 kHz) ± 0.08%	Fluke Model 5100B
Resistors	1Ω to 10MΩ (in decade steps) ± 0.05%	
Frequency Counter	To measure positive 100 msec. pulse with 1μsec resolution	Fluke Model 1953A
Oscilloscope	General Purpose	Tektronix 545B W/1A1 plug-in

4-5. GENERAL MAINTENANCE

4-6. Access Information

4-7. Use the following procedure to gain access to the interior of the 8000A/BU:

1. Set the POWER switch to off, and disconnect the line cord.
2. Remove the phillips screw at the rear of the instrument case.
3. Separate the instrument from the case.

4-8. Cleaning

4-9. Clean the 8000A/BU periodically to remove dust, grease, and other contaminants. Use the following procedure:

CAUTION

Do not use aromatic hydrocarbons or chlorinated solvents to clean the 8000A/BU. They will react with the plastic materials used in the instrument.

1. Clean the surface of the pcb using clean dry air at low pressure (⩽ 20 psi). If grease is encountered, spray with Freon T. G. Degreaser and remove grime with clean dry air at low pressure.
2. Clean the front panel and case with a soft cloth dampened with a mild solution of detergent and water.

4-10. Battery Replacement

4-11. Use the following procedure for removing and replacing batteries:

CAUTION

Do not attempt to charge alkaline, zinc-carbon, or mercury batteries in the 8000A/BU.

1. Disconnect line cord. Remove retaining screw at rear of instrument case, and remove instrument from case.
2. On the underside of the pcb, remove the two threaded bolts securing the battery holders.
3. Remove the holder tops and batteries.
4. Replace the batteries with 1.2 volt nickel-cadmium batteries (JF Part No. 346924). Install the batteries in the direction indicated by the polarity markings on the battery holder.

4-12. Fuse Replacement

4-13. The input power fuse F1 is located on the interior of the instrument near the power transformer. Replace with an MDL 1/8A (slo-blo). Do not use a different type of fuse.

CAUTION!

Line potential exists on the fuseholder whenever the instrument is plugged into the line.

4-14. The current shunt protection fuse F2 is located behind the front panel MA INPUT connector. To remove the fuse, turn the MA INPUT connector ccw and pull it out. Use a 2 amp AGX replacement fuse.

4-15. Service Tools

4-16. No special tools are required to maintain or repair the 8000A/BU.

4-17. PERFORMANCE TEST

4-18. The performance test is designed to verify the overall operation of the 8000A/BU. The test can be used as an acceptance check and/or periodic maintenance check. Table 4-1 lists the equipment required to perform this test. If the 8000A/BU fails any part of the performance test, corrective action is indicated. Troubleshooting information for fault isolation is given later in this section.

NOTE

The performance test should be performed at an ambient temperature of +22 to +25° C and at a relative humidity of less than 70%.

4-19. Zero Offset Test

4-20. Use the following procedure to test the zero offset of the 8000A/BU:

1. Connect the unit to live power.
2. Energize the instrument and depress the DCV and 200 mV pushbuttons.
3. Place a shorting jumper between the V-Ω and COMMON input connectors. The readout should indicate 00.0, flashing ± 00.1 not more than 10 times in 10 seconds.
4. Remove the shorting jumper. The readout should indicate ⩽ ± 01.0.

4-21. Analog Meter Test

4-22. Use the following procedure to check the front panel meter:

1. Select the 200 MV DC range and place a shorting jumper between the V-Ω and COMMON input connectors. Meter deflection should be 0 ± ¼ of 1 division.
2. Select the 2V DC range. The zero indication should not change by more than ¼ of 1 division.

3. Remove the short at the input terminals and replace with a +1V dc input signal. The meter should read 1V dc ±10% of full scale (half scale).

4. Increase the input signal to +2V dc. The meter should read 2V dc ±10% of full scale (full scale).

5. Reverse the polarity of the +2V dc input signal. The meter should read 2V dc ± 10% of full scale (full scale).

6. Press the BATTERY TEST switch. The meter should indicate charge (CHG).

4-23. Accuracy Test

4-24. The accuracy test compares the instrument's performance to the accuracy specifications listed in Section 1. To perform the accuracy test refer to Range Adjustments/Checks (given later in this section) and check the accuracy of each of the listed functions and ranges. Disregard the adjustment column of Table 4-2.

Table 4-2. 8000A/BU Adjustments and Checks

FUNCTION/ RANGE	INPUT	ADJUSTMENT	DISPLAY LIMITS
DCV / 200 MV	+190 MV	"200 MVDC" (R23) Adjust for +190.0	+189.7 to +190.3
DCV / 2	+1.9V dc	"2 VDC" (R25) Adjust for +1.900	+1.897 to +1.903
DCV / 20	+19V dc	– – – – – – – – –	+18.97 to +19.03
DCV / 200	+190V dc	– – – – – – – – –	+189.7 to +190.3
DCV / 1200V	+1000V dc	– – – – – – – – –	+998 to +1002
20 MΩ	10 MΩ	"20 M" (R55) Adjust for 10.00	9.94 to 10.06
KΩ / 20	10 KΩ	"K OHM" (R12) Adjust for 10.00	9.97 to 10.03
KΩ / 200Ω	100Ω	– – – – – – – – –	99.7 to 100.3
KΩ / 2	1 KΩ	– – – – – – – – –	.997 to 1.003
KΩ / 200	100 KΩ	– – – – – – – – –	99.7 to 100.3
KΩ / 2000 KΩ	1 MΩ	– – – – – – – – –	997 to 1003
DC MA / 200 μA	+190 μA	– – – – – – – – –	+189.3 to +190.7
DC MA / 2	+1.9 mA	– – – – – – – – –	+1.893 to +1.907
DC MA / 20	+19 mA	– – – – – – – – –	+18.93 to +19.07
DC MA / 200	+190 mA	– – – – – – – – –	+189.3 to +190.7
DC MA / 2000 MA	+1.9A	– – – – – – – – –	+1893 to 1907
ACV / 20V	10V @ 50 kHz	HF ADJ (C3) Adjust for 10.00	9.68 to 10.32
ACV / 20V	19V @ 100 Hz	– – – – – – – – –	18.88 to 19.12
ACV / 20V	19V @ 10 kHz	– – – – – – – – –	18.88 to 19.12
ACV / 200V	100V @ 100 Hz	– – – – – – – – –	99.3 to 100.7
ACV / 200V	100V @ 50 kHz	– – – – – – – – –	96.8 to 103.2
ACV / 200V	190V @ 100 Hz	– – – – – – – – –	188.8 to 191.2
ACV / 200V	190V @ 10 kHz	– – – – – – – – –	188.8 to 191.2
ACV / 1200V	1000V @ 100 Hz	– – – – – – – – –	993 to 1007
ACV / 1200V	1000V @ 10 kHz	– – – – – – – – –	998 to 1012
ACV / 1200V	1000V @ 20 kHz	– – – – – – – – –	998 to 1012
ACV / 1200V	400 @ 50 kHz	Select C33 for reading of 400.0 ±5 digits	386 to 414

4-25. CALIBRATION

4-26. The 8000A/BU should be calibrated at least once a year or whenever repairs have been made. Calibration should be accomplished at an ambient room temperature of +22 to +25° C, and at a relative humidity of less than 70%. Table 4-1 lists the required equipment and Figure 4-1 defines the locations of the specified adjustments.

4-27. Initial Procedure

4-28. Remove the case from the 8000A/BU and energize the instrument.

WARNING!

The input power connector is at the ac line potential (115 ac), Use caution when working in this area.

4-29. Period Adjustment

4-30. Use the following procedure to adjust the 8000A/BU measurement period:

1. Connect the frequency counter between TP5 and TP4 (common) as shown in Figure 4-1.
2. Set the frequency counter to the time interval operating mode.
3. Using an appropriate adjusting tool, adjust R20 (Period), shown in Figure 4-1, for a time period of 100 ms ± 5 μs. Variations of the time period should be ⩽ ± 15 μs.

4-31. Turn-Over Error Adjustment

4-32. Use the following procedure to adjust the turn-over error:

1. Depress the DCV and the 200 MV pushbuttons.
2. Install a shorting jumper between the V-Ω and common input connectors. The readout should indicate 00.0, flashing ±00.1 not more than 10 times in 10 seconds. Adjust R15, if required, to meet the zero offset specified.
3. Connect a dc voltage source to the V-Ω and COMMON inputs. Set the supply for a +190 mV output.
4. Adjust R23 (see Figure 4-1) for a readout of +190.0.
5. Change the input voltage from +190 mV to −190 mV.
6. Readout should indicate −190.0 ± .1. If the readout is not in limits, adjust R15 to obtain a correct reading.
7. Repeat steps 2 and 6 and readjust R15, if necessary, to meet both requirements.

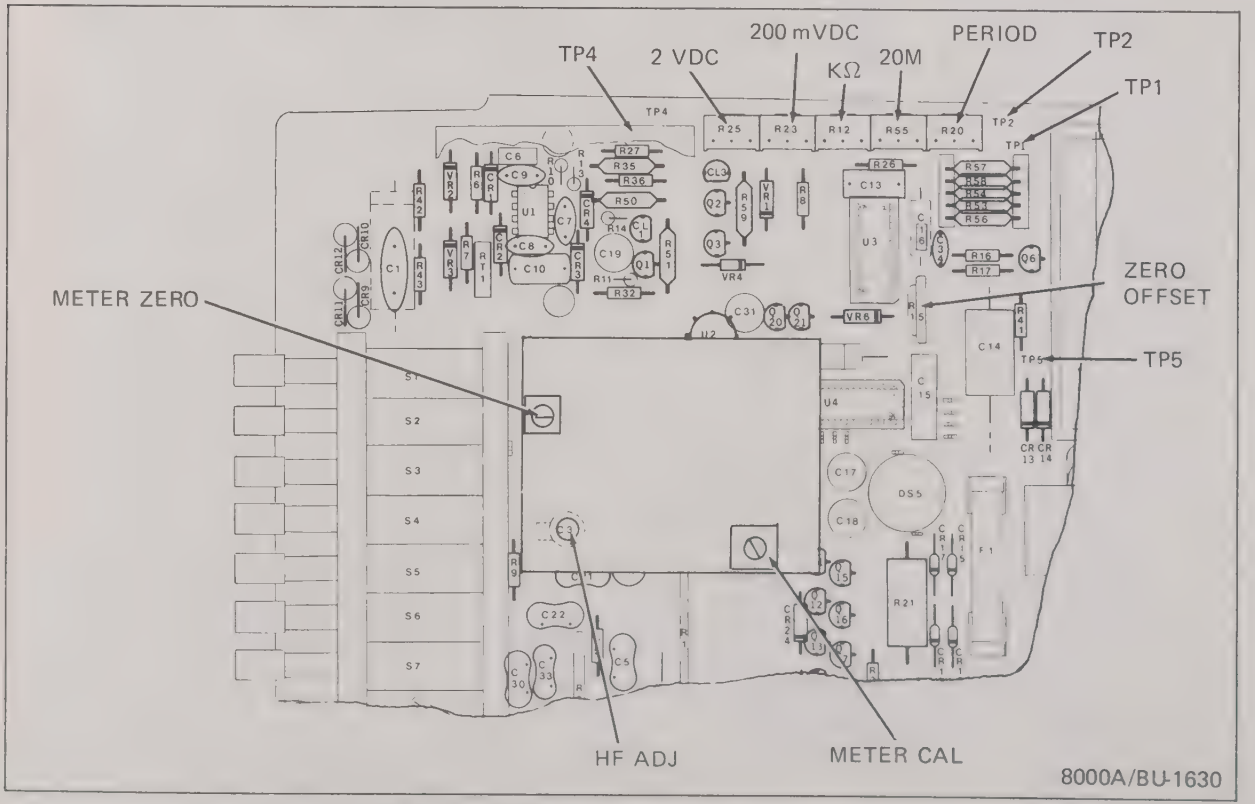


Figure 4-1. Adjustment and Test Point Locations

4-33. Analog Meter Adjustment

4-34. Use the following procedure to adjust the analog meter circuit:

1. Depress the DCV and 200 MV pushbuttons.
2. Connect a shorting jumper between the V-Ω and COMMON input connectors.
3. Adjust the METER ZERO pot (R7) for a minimum meter deflection.
4. Remove the short at the input terminals and replace with a +1V dc input signal. The meter should read 1V dc ±10% (half scale).
5. Increase the input signal to +2V dc.
6. If necessary, readjust METER CAL pot (R10) for a reading of +2V dc ±10% (full scale). Repeat steps 4 and 5 to ensure meter accuracy with a +1V dc input signal.

4-35. Range Adjustment/Checks

4-36. Make the 8000A/BU range adjustments as given in the instructions in Table 4-2. Perform each adjustment and/or check in the order listed. Refer to Figure 4-1 for the location of the specified adjustment. The following test equipment from Table 4-1 is used to provide the input specified for each function.

1. DCV - DC Voltage Source
2. 20MΩ - Resistors
3. KΩ - Resistors
4. DC MA - DC Current Source
5. ACV - AC Voltage Source

4-37. Troubleshooting

4-38. The following information is designed to aid in troubleshooting the 8000A/BU. The performance test isolates the problem to a functional circuit group using troubleshooting flow charts. The flow chart symbols are defined in Figure 4-2 and the troubleshooting flow charts are given in Figure 4-3.

CAUTION

Static discharge can damage MOS components contained in the 8000A/BU.

4-39. When troubleshooting or repairing the 8000A/BU use the following precautions to prevent damage from static discharge:

1. Never remove, install, or otherwise connect or disconnect components without first turning the 8000A/BU power switch to OFF.
2. Perform all repairs at a static-free work station.
3. Do not handle ICs or pcb by their connectors.
4. Use static ground straps to discharge repair personnel.
5. Use conductive foam to store replacement or removed ICs.
6. Remove all plastic, vinyl, and styrofoam products from the work area.
7. Use a grounded soldering iron.

4-40. If a component is found to be defective in either the Input Divider Resistor Set, the Analog Resistor Set, or the Ohms Resistor Set, the complete set must be replaced. The components contained in each set are listed in Section 5 by reference designator. Typical descriptions of each component are also given.

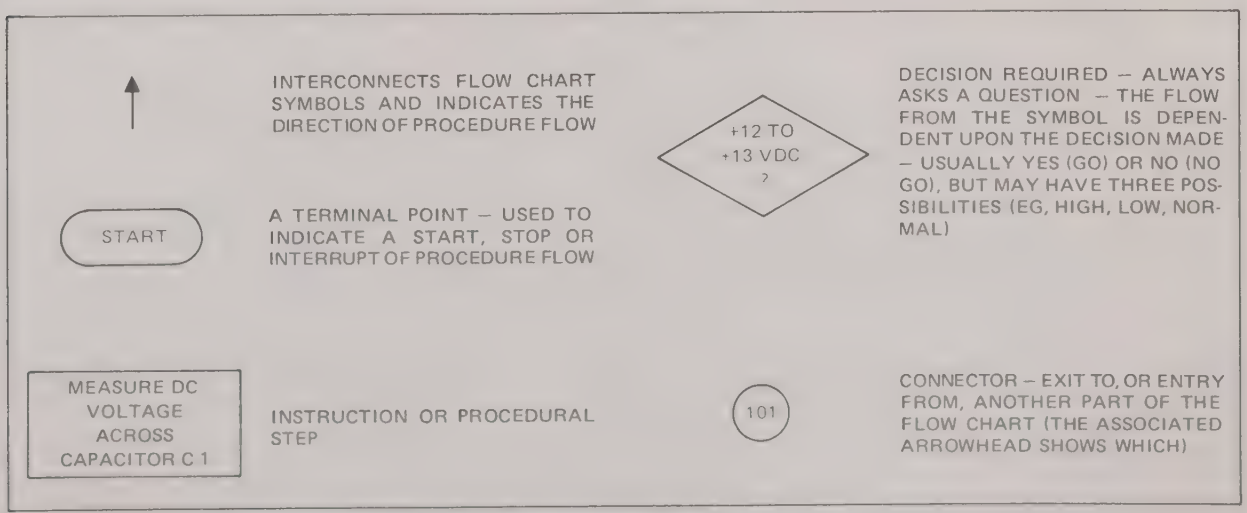

INTERCONNECTS FLOW CHART SYMBOLS AND INDICATES THE DIRECTION OF PROCEDURE FLOW
+12 TO +13 VDC ?
DECISION REQUIRED – ALWAYS ASKS A QUESTION – THE FLOW FROM THE SYMBOL IS DEPENDENT UPON THE DECISION MADE – USUALLY YES (GO) OR NO (NO GO), BUT MAY HAVE THREE POSSIBILITIES (EG, HIGH, LOW, NORMAL)
START
A TERMINAL POINT – USED TO INDICATE A START, STOP OR INTERRUPT OF PROCEDURE FLOW
MEASURE DC VOLTAGE ACROSS CAPACITOR C 1
INSTRUCTION OR PROCEDURAL STEP
101
CONNECTOR – EXIT TO, OR ENTRY FROM, ANOTHER PART OF THE FLOW CHART (THE ASSOCIATED ARROWHEAD SHOWS WHICH)

Figure 4-2. Troubleshooting Flow Chart Symbols

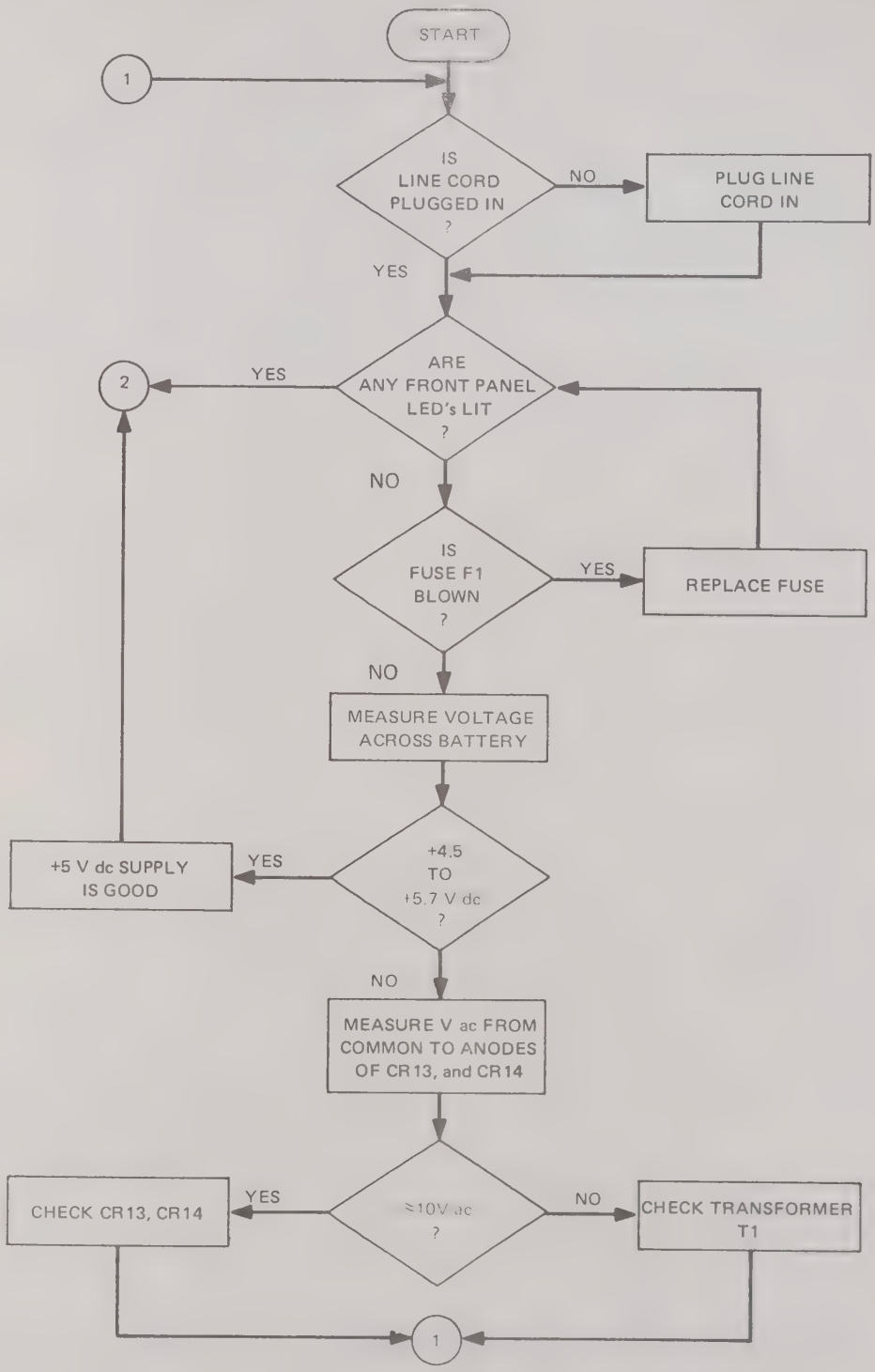


Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 1 of 8)

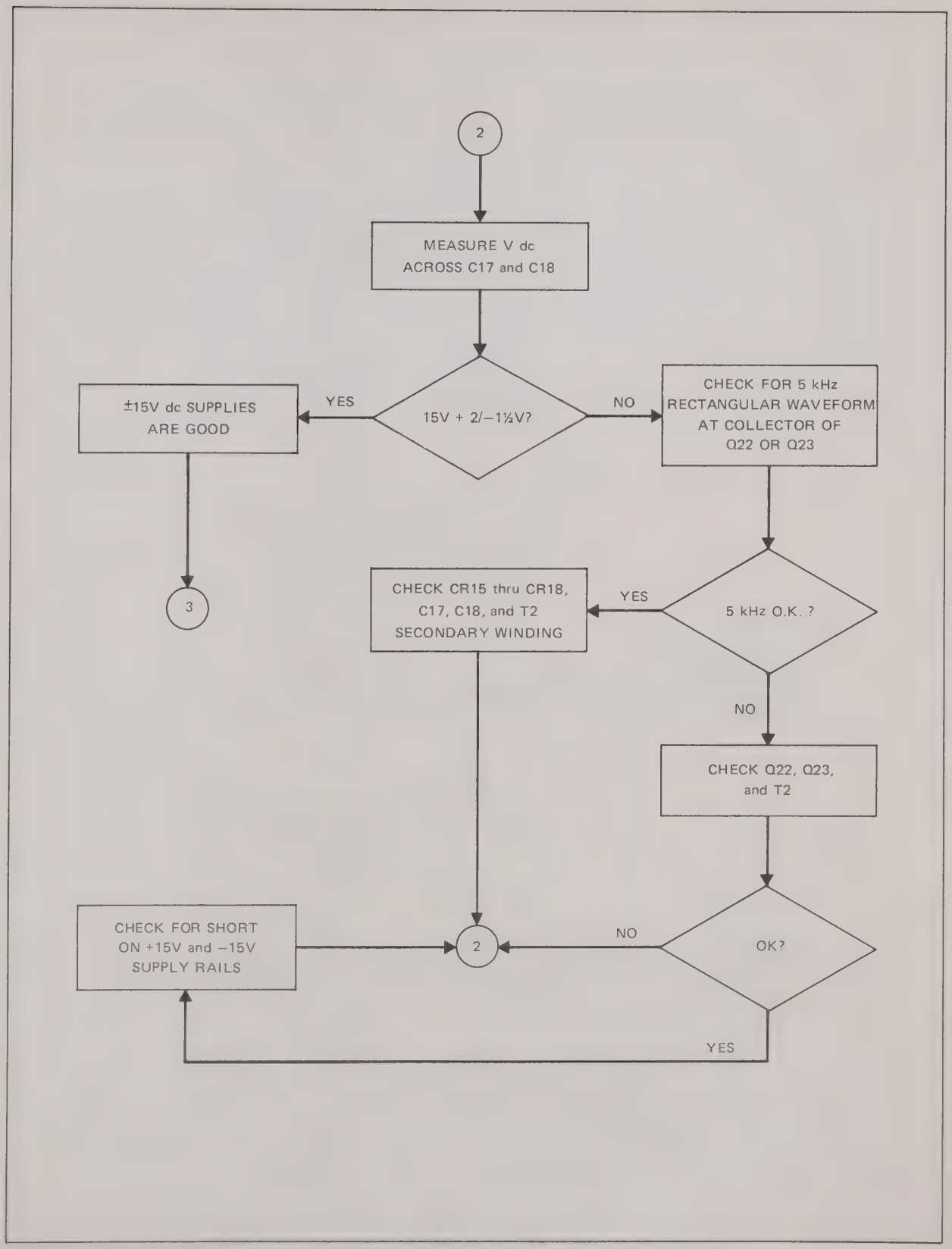


Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 2 of 8)

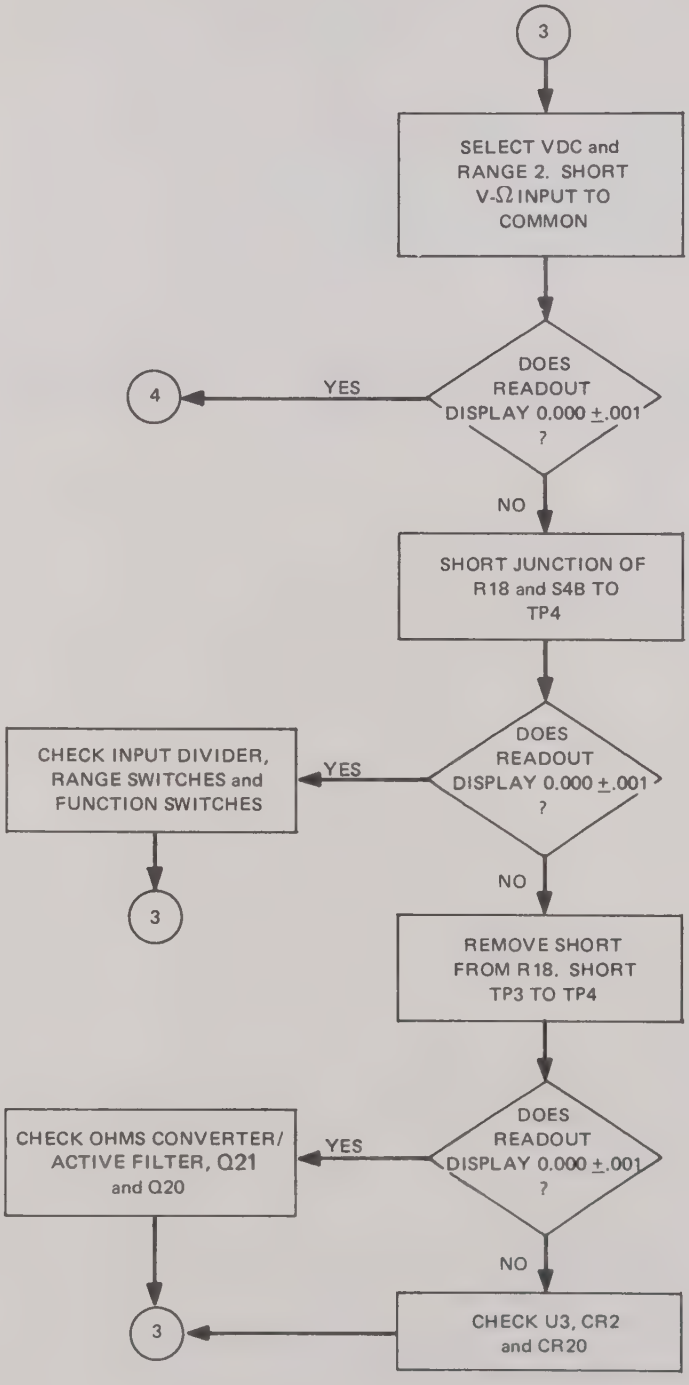


Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 3 of 8)

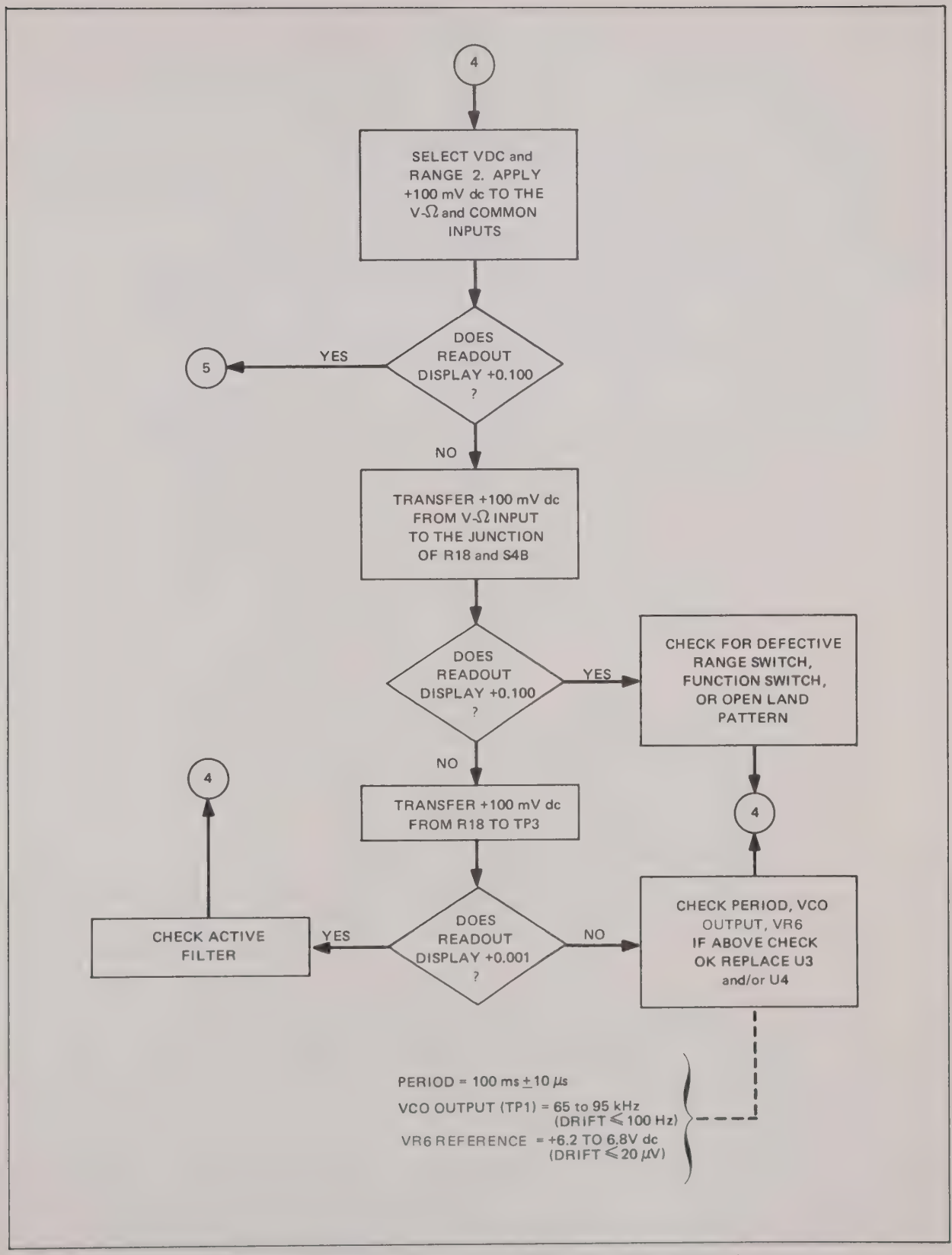

4
SELECT VDC and RANGE 2. APPLY +100 mV dc TO THE V-Ω and COMMON INPUTS
DOES READOUT DISPLAY +0.100 ?
YES
5
NO
TRANSFER +100 mV dc FROM V-Ω INPUT TO THE JUNCTION OF R18 and S4B
DOES READOUT DISPLAY +0.100 ?
YES
CHECK FOR DEFECTIVE RANGE SWITCH, FUNCTION SWITCH, OR OPEN LAND PATTERN
NO
4
TRANSFER +100 mV dc FROM R18 TO TP3
4
DOES READOUT DISPLAY +0.001 ?
YES
CHECK ACTIVE FILTER
NO
CHECK PERIOD, VCO OUTPUT, VR6 IF ABOVE CHECK OK REPLACE U3 and/or U4
PERIOD = 100 ms ± 10 µs
VCO OUTPUT (TP1) = 65 to 95 kHz (DRIFT ≤ 100 Hz)
VR6 REFERENCE = +6.2 TO 6.8V dc (DRIFT ≤ 20 µV)

Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 4 of 8)

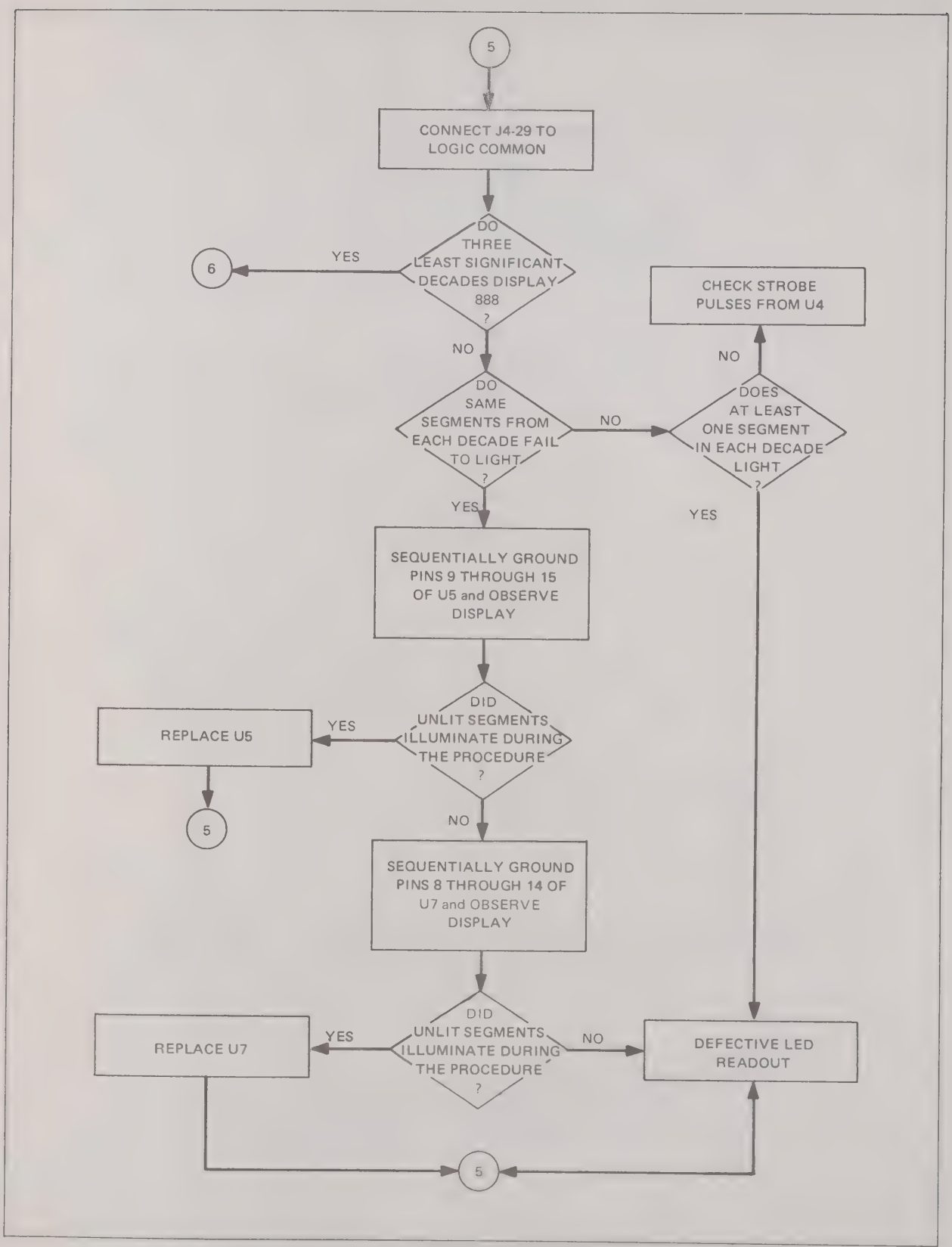


Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 5 of 8)

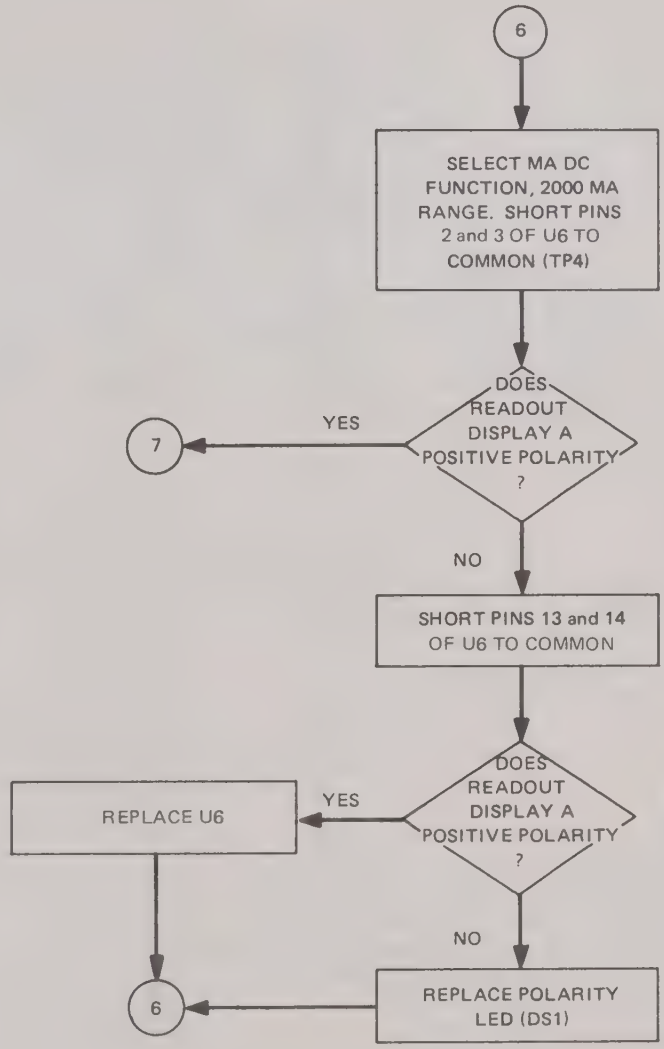

6
SELECT MA DC FUNCTION, 2000 MA RANGE. SHORT PINS 2 and 3 OF U6 TO COMMON (TP4)
DOES READOUT DISPLAY A POSITIVE POLARITY ?
YES
7
NO
SHORT PINS 13 and 14 OF U6 TO COMMON
DOES READOUT DISPLAY A POSITIVE POLARITY ?
YES
REPLACE U6
NO
REPLACE POLARITY LED (DS1)
6

Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 6 of 8)

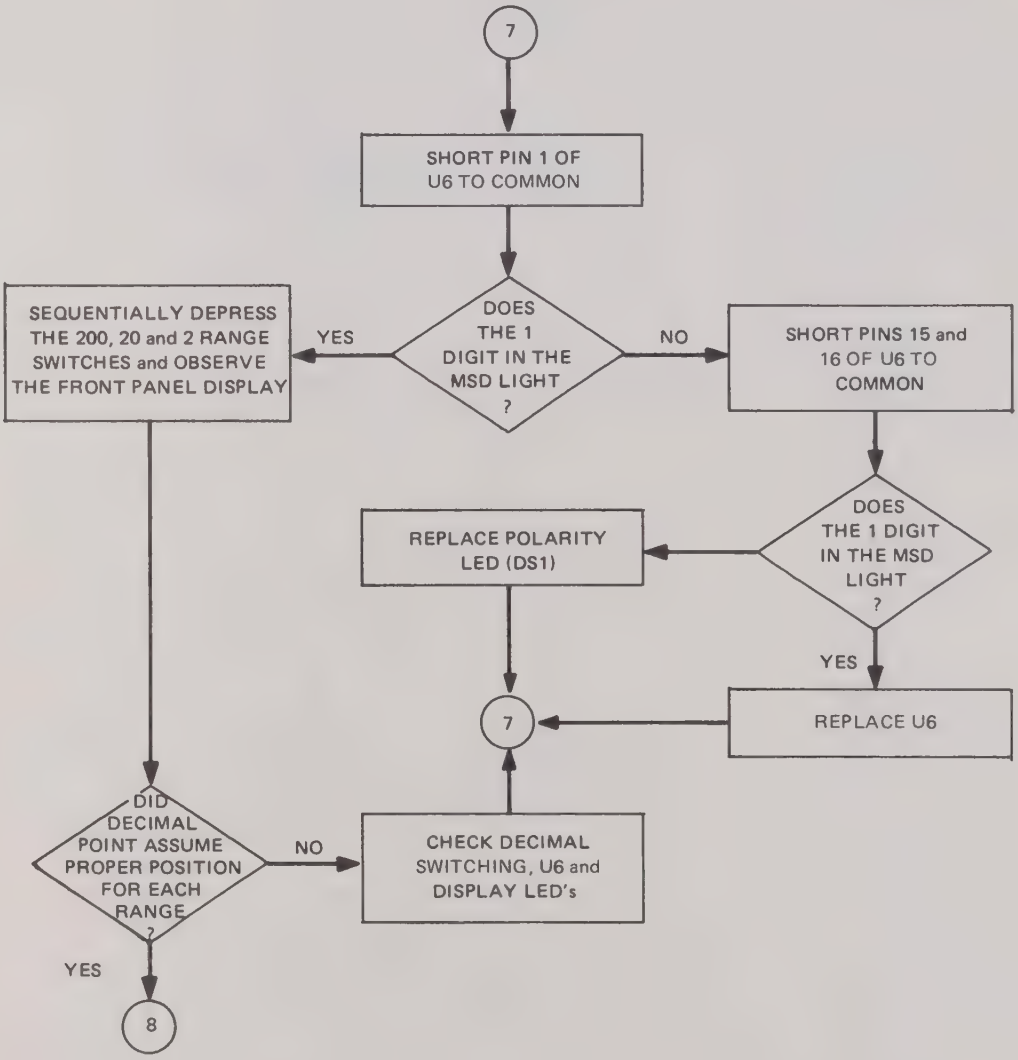

7
SHORT PIN 1 OF U6 TO COMMON
DOES THE 1 DIGIT IN THE MSD LIGHT ?
YES
NO
SEQUENTIALLY DEPRESS THE 200, 20 and 2 RANGE SWITCHES and OBSERVE THE FRONT PANEL DISPLAY
SHORT PINS 15 and 16 OF U6 TO COMMON
DOES THE 1 DIGIT IN THE MSD LIGHT ?
REPLACE POLARITY LED (DS1)
YES
REPLACE U6
7
DID DECIMAL POINT ASSUME PROPER POSITION FOR EACH RANGE ?
NO
CHECK DECIMAL SWITCHING, U6 and DISPLAY LED's
YES
8

Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 7 of 8)

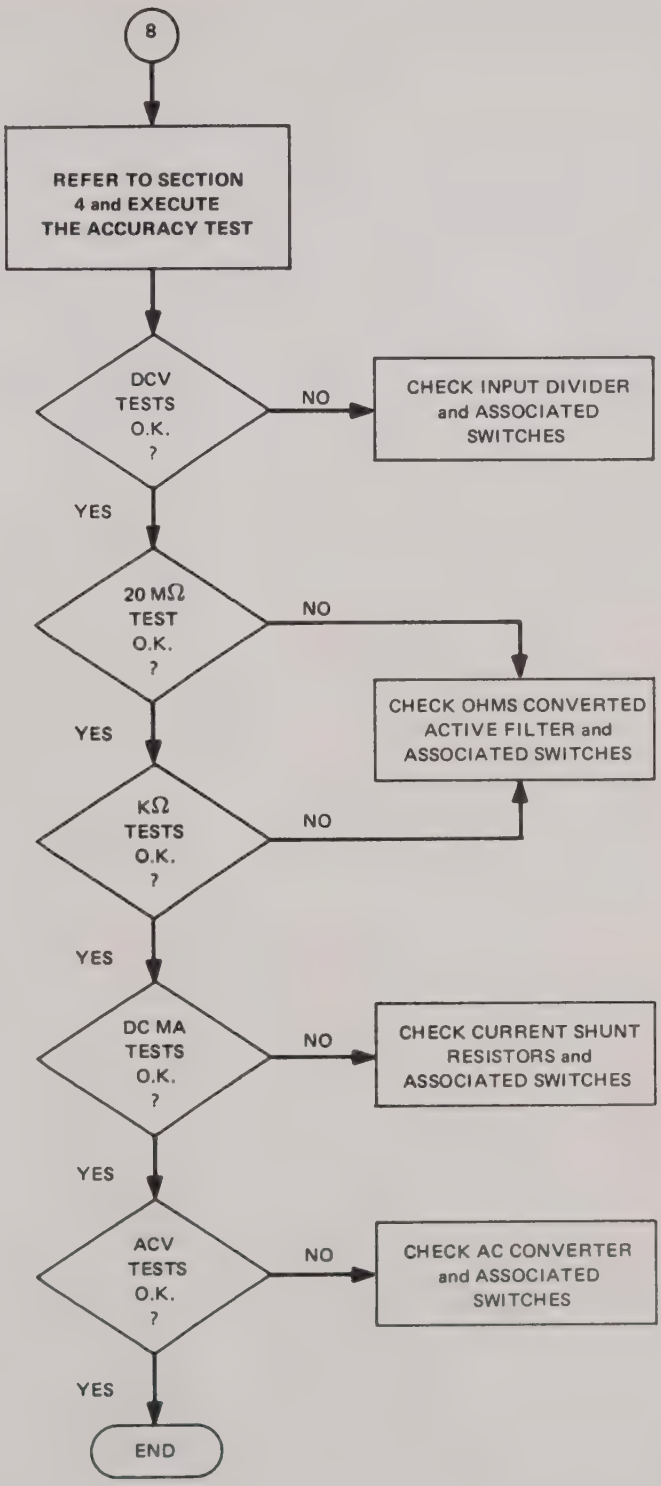


Figure 4-3. 8000A/BU Troubleshooting Flow Chart (Sheet 8 of 8)

Section 5
List of Replaceable Parts

TABLE OF CONTENTS

	ASSEMBLY NAME	DRAWING NO.	TABLE NO.	TABLE PAGE	FIGURE NO.	FIGURE PAGE
	Final Assembly, Model 8000A/BU	8000A/BU-T&B	5-1	5-3	5-1	5-4
A1	Main Assembly	8000A/BU-4030	5-2	5-5	5-2	5-6
A1A1	Main PCB Assembly	8000A/BU-4030S	5-3	5-8	5-3	5-11
A1A2	Display PCB Assembly	8000A/4-16	5-4	5-13	5-3	5-11
A1A3	Meter II Circuit PCB Assembly	8000A/BU-4015S	5-5	5-14	5-4	5-14

5-1. INTRODUCTION

5-2. This section contains an illustrated parts breakdown of the instrument. A similar parts listing for each of the Options will be found in Section 6. Components are listed alphanumerically by assembly. Both electrical and mechanical components are listed by reference designation. Each listed part is shown in an accompanying illustration.

5-3. Parts lists include the following information:

1. Reference Designation.
2. Description of each part.
3. FLUKE Stock Number.
4. Federal Supply Code for Manufacturers. (See Section 7 for Code-to-Name list.)
5. Manufacturer's Part Number.
6. Total Quantity of components per assembly.
7. Recommended Quantity: This entry indicates the recommended number of spare parts necessary to support one to five instruments for a period of 2 years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for 1 year or more at an isolated site, it is recommended that at least one of each assembly in the instrument be stocked (see paragraph 5-7). In the case of optional subassemblies, plug-ins, etc., that are not always part of the instrument, or are deviations from the basic instrument model, the REC QTY column lists the recommended spares quantity for the items in that particular assembly.

5-4. HOW TO OBTAIN PARTS

5-5. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. or its authorized representatives by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To ensure prompt and efficient handling of your order, include the following information.

1. Quantity.
2. FLUKE Stock Number.
3. Description.
4. Reference Designation.
5. Printed Circuit Board Part Number and Revision Letter.
6. Instrument Model and Serial Number.

5-7. A Recommended Spare Parts Kit for your basic instrument is available from the factory. This kit contains those items listed in the REC QTY column of the parts list in the quantities recommended.

5-8. Parts price information is available from the John Fluke Mfg. Co., Inc. or its representatives. Prices are also available in a Fluke Replacement Parts Catalog, which is available on request.

⊗CAUTION

Indicated devices are subject to damage by static discharge.

Table 5-1. Final Assembly, 8000A/BU

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
	FINAL ASSEMBLY, 8000A/BU FIGURE 5-1						
A1	MAIN ASSEMBLY	ORDER	NEXT	HIGHER LEVEL	1		
F1	FUSE, 2A FAST ACTING	376582	71400	AGX-2	1		
H1	SCREW, 6-20 X 3/8	288266	89536	288266	2		
H2	WASHER, FLAT	340505	89536	340505	2		
H3	SCREW, PHP, 6-32 X 3/8	334458	89536	334458	1		
H4	SCREW, PHP, 6-32 X 1/2	320051	89536	320051	1		
MP1	DECAL, KNOB	347401	89536	347401	2		
MP2	HANDLE, MOLDED	330092	89536	330092	1		
MP3	DECAL, GEN. SPEC.	584995	89536	584995	1		
MP4	DECAL, GEN. SPEC.	343764	89536	343764	1		
MP5	PAD, FOOT	338632	89536	338632	2		
MP6	CASE, MOLDED	330076	89536	330076	1		
MP7	SHIELD, BOTTOM	351791	89536	351791	1		
MP8	SHIELD, BOTTOM, ALUM.	351809	89536	351809	1		
MP9	INSULATOR	344184	89536	344184	1		
MP10	TEST LEAD SET, NOT SHOWN	158972	89536	158972	1		
MP11	82RF PROBE KIT (FIGURE 6-6)	583609	89536	583609	1		
R30	RES. 6.8 K (MAY NOT BE INCLUDED)	368761	80031	CR251-4-5P6KE	1		
R40	RES. 215 K ((MAY NOT BE INCLUDED)	289470	94637	CMF552153F	1		
R53, R54							2
R56-R58							1
U3							2
U4	IC, MOS, LSI	418814	17856	SC523	1		
VR7	DIODE, ZENER, 6.8 V	352898	99942	R4852	1		
W1	LINE CORD ASSY. (NOT SHOWN)	343723	89536	343723	1		
TM	INSTRUCTION MANUAL (NOT SHOWN)	471706	89536	471706	1		
	RECOMMENDED SPARE PARTS KIT	481192	89536	481192	AR		

NOTES:

1 R53, R54, R59*, CR3* AND U2* ARE A MATCHED SET. FOR REPLACEMENT ORDER PART NO. 345504.

2 R56, R57, R58, U3, VR6*, C14* AND C16*, ARE A MATCHED SET. FOR REPLACEMENT ORDER PART NO. 476226.

* SEE A1A1 MAIN PCB ASSY.

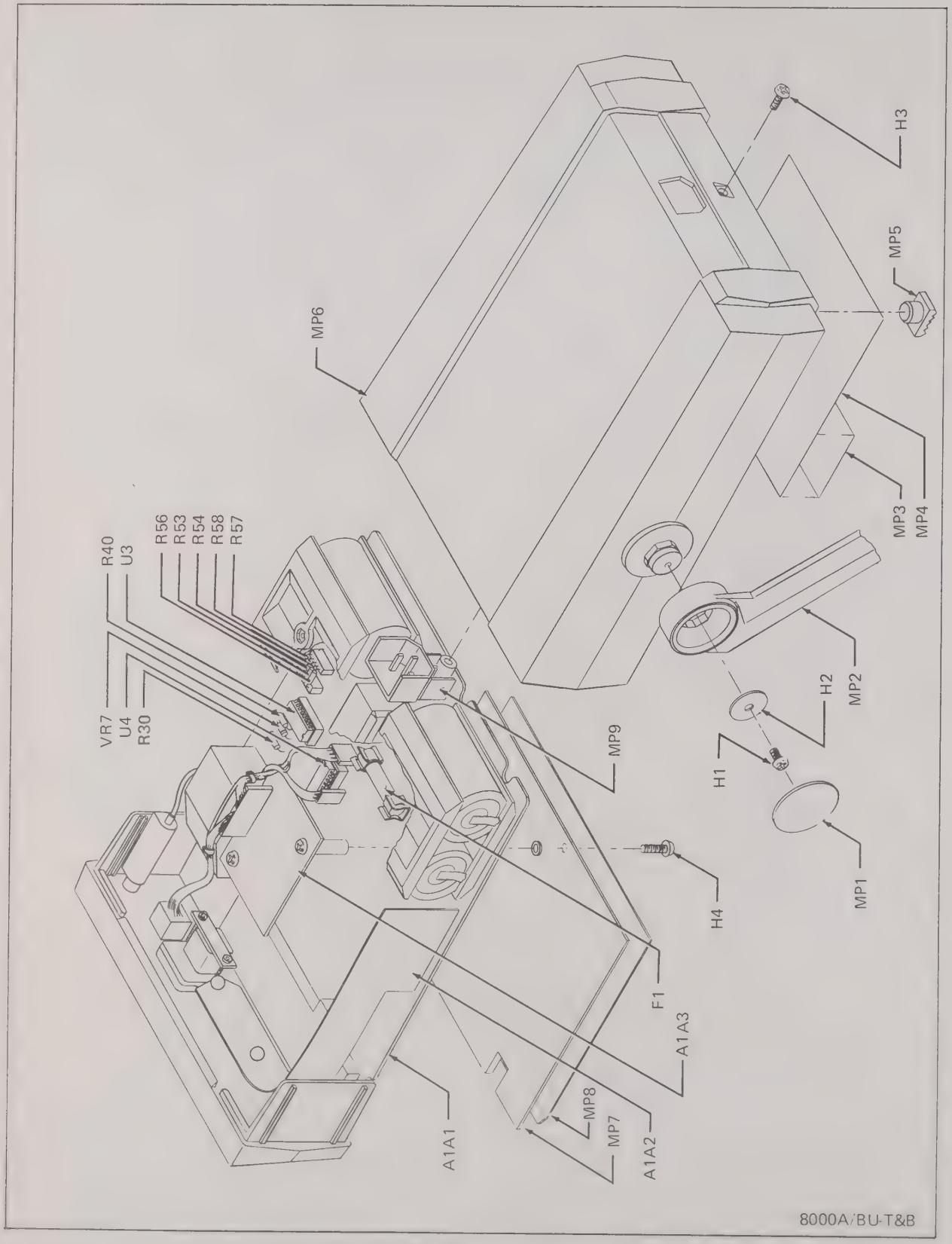


Figure 5-1. Final Assembly, 8000A/BU

Table 5-2. A1 Main Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1	MAIN ASSEMBLY (8000A/BU-4030) FIGURE 5-2	ORDER	NEXT	HIGHER LEVEL	REF		
A1A1	MAIN PCB ASSEMBLY	ORDER	NEXT	HIGHER LEVEL	REF		
A1A2	DISPLAY PCB ASSEMBLY	ORDER	NEXT	HIGHER LEVEL	REF		
A1A3	METER II CIRCUIT PCB ASSEMBLY	ORDER	NEXT	HIGHER LEVEL	REF		
BT1	BATTERY, NI. CAD. 1.2 V	474353	89536	474353	4		
BT2	BATTERY, NI. CAD. 1.2 V	474353	89536	474353	REF		
BT3	BATTERY, NI. CAD. 1.2 V	474353	89536	474353	REF		
BT4	BATTERY, NI. CAD. 1.2 V	474353	89536	474353	REF		
DS5	LAMP	352237	08806	63	1		
F2	FUSE, FAST ACTING, 2 AMP	376582	71400	AGX-2	1	5	
H1	SCREW, THD FORMING 1/4	352674	89536	352674	1		
H2	SCREW	114942	89536	114942	2		
H3	SCREW, 2-56 X 1.00	417444	89536	417444	2		
H4	WASHER, FLAT .261 1D	200980	89536	200980	1		
H5	NUT, 6-32	110551	89536	110551	2		
H6	SCREW, PHP, 6-32 X 1.56	347427	89536	347427	2		
H7	SCREW, PHP, 6-32 X 1/2	320051	89536	320051	2		
J1	JACK, BANANA, TYPE 108-902, RED	162065	74970	108902	1		
J2	JACK, BANANA, TYPE 108-903, BLK	162073	74970	108-0903-001	1		
J3	FUSEHOLDER, INPUT	345611	89536	345611	1		
M1	8000A METER	581470	89536	581470	1		
MP1	RETAINING STRAP	439356	89536	439356	1		
MP2	FRONT PANEL, MOLDED	439331	89536	439315	1		
MP3	RETAINER	352484	77969	9109-E	1		
MP4	SOLDER LUG, COPPER	101501	79963	327	1		
MP5	DECAL FRONT PANEL	581496	89536	581496	1		
MP6	DECAL, BATTERY TEST	439315	89536	439315	1		
MP7	LENS, DISPLAY	439323	89536	439323	1		
MP8	WIRE ASSY., FUSE	420869	89536	420869	1		
MP9	SPRING, COMPRESSION	422824	83553	C0240-026-0500-S	1		
MP10	WIRE HARNESS	581686	89536	581686	1		
MP11	INSULATOR, RECEPT.	338624	89536	338624	1		
MP12	HOLDER, BATTERY	390450	89536	390450	4		
MP13	SHIELD, AC CONV.	415729	89536	415729	1		
MP14	BLOTTER, DISC	458653	89536	458653	4		
MP15	BLOTTER, INSERT	458661	89536	458661	2		
MP16	LABEL, BATTERY	394049	89536	394049	2		
MP17	BUTTON, GREEN	352211	52305	71590	1		
MP18	JUMPER	361451	89536	361451	1		
MP19	SPACER, STANDOFF (NOT SHOWN)	266486	89536	266486	2		
S13	SWITCH, DPDT MOMENTARY	573873	89536	573873	1		
XF1	FUSEHOLDER	415711	89536	415711	1		

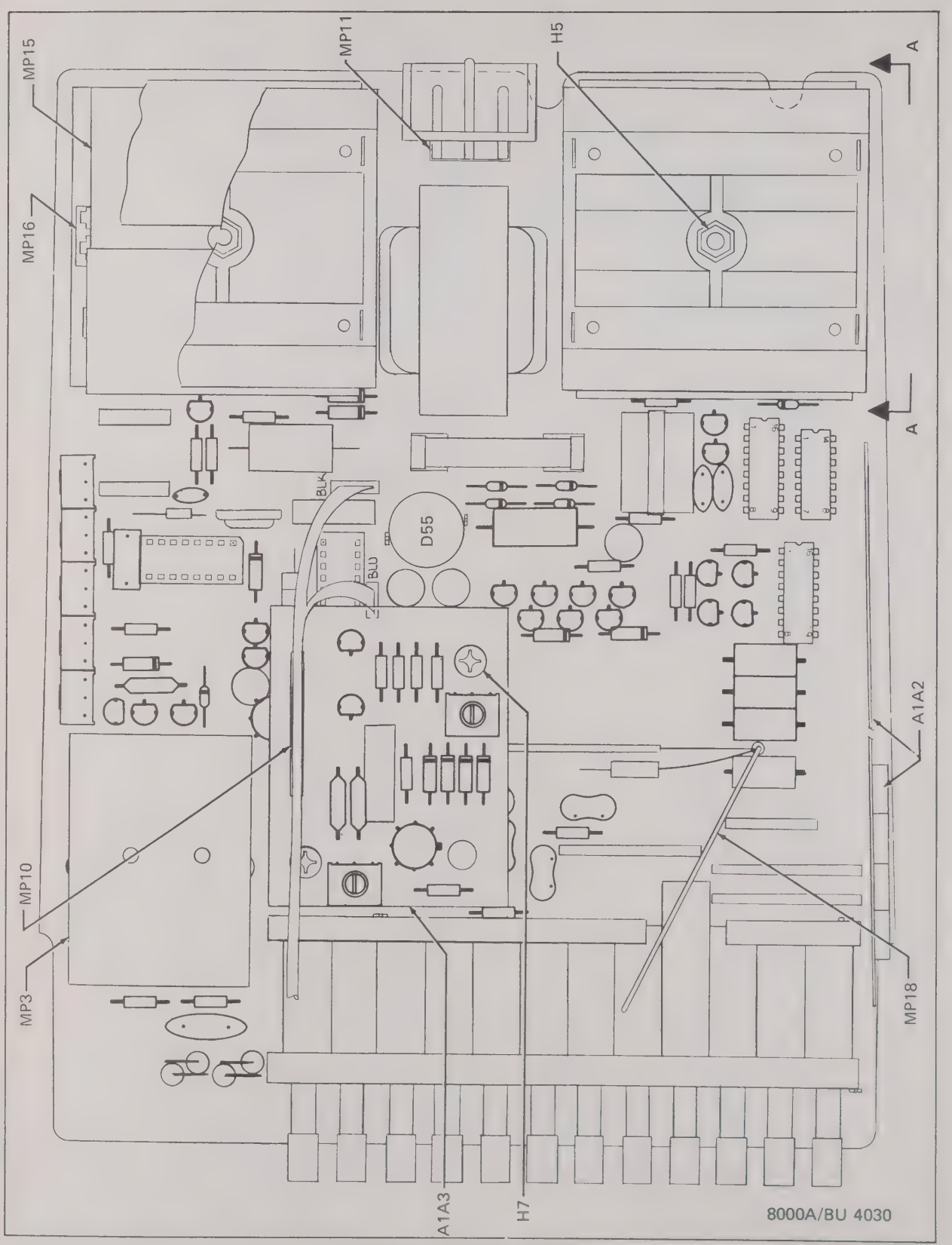
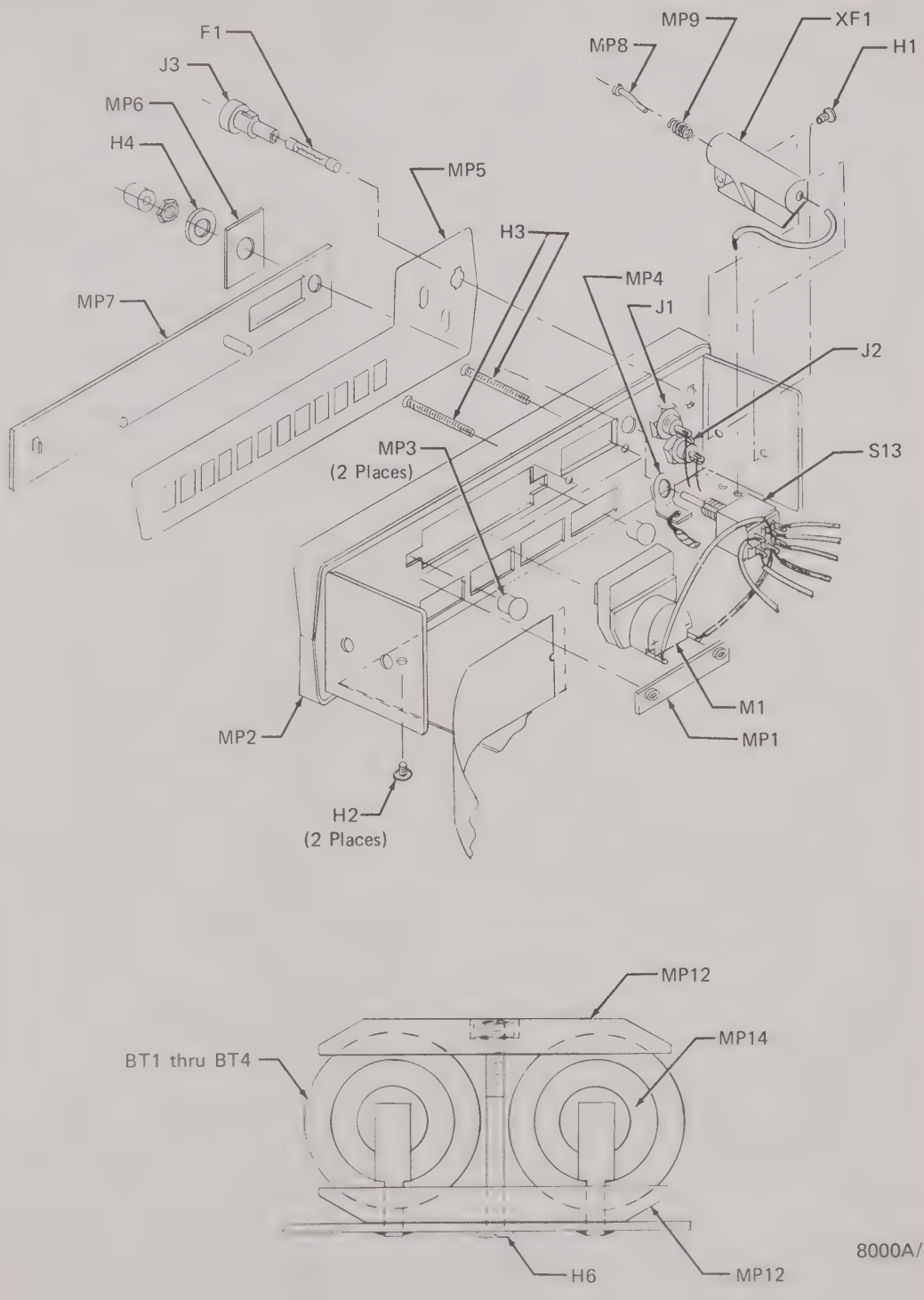


Figure 5-2. A1 Main Assembly



VIEW A - A

Figure 5-2. A1 Main Assembly (cont)

Table 5-3. A1A1 Main PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1A1	MAIN PCB ASSEMBLY (8000A/BU-4030S) FIGURE 5-3	ORDER	NEXT	HIGHER LEVEL	REF		
C1	CAP, CER DISC, 50,000 PF	355420	56289	41C169A3	1		
C2	CAP, PORC, 5.1 PF, +/-25%, 1000V	347948	95275	VY13C5R1CA	1		
C3	CAP, VAR, 4.5 - 50 PF, 250V	321117	73899	DVJ305A	1	1	
C4	CAP, MICA, 510 PF +/-5%, 500V	148411	72136	DM19ES11J	1		
C5	CAP, MICA, 56 PF +/-5%, 500V	148528	72136	DM15F560S	2		
C6	CAP, MINI CER., 0.1 UF	573808	89536	573808	1		
C7	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F103M	2		
C8	CAP, CER, 0.01 UF +/-20%, 100V	149153	56289	C023B101F103M	REF		
C9	CAP, CER 7.5 PF, 1300V	106849	56289	C028B102E7R5M	1		
C10	CAP, POLY, 0.10 UF +/-10%, 100V	446781	89536	446781	1		
C11	CAP, PLSTC, 0.033 UF +/-10%, 50V	271841	06001	75F1R5A333	1		
C12	CAP, POLY, 0.22 UF +/-10%, 100V	333823	84171	1PJ223K	1		
C13	CAP, PLSTC, 0.047 UF +/-10%, 50V	271858	06001	75F1R5A473	1		
C14	CAP, (MATCHED SET)				1	1	
C15	CAP, PLSTC, 0.22 UF +/-10%, 250V	194803	25088	B32234A3224K	1		
C16	CAP, (MATCHED SET)				1	1	
C17	CAP, TA, 47 UF +/-20%, 20V	348516	56289	196D476X0020LA3	4		
C18	CAP, TA, 47 UF +/-20%, 20V	348516	56289	196D476X0020LA3	REF		
C19	CAP, TA, 68 UF +/-20%, 15V	193615	56289	196D686X0015LA3	1		
C21	CAP, MICA, 39 PF +/-5%, 500V	148544	72136	DM15E390J	2		
C22	CAP, MICA, 390 PF +/-5%	148437	72136	DM15F391J	1		
C23	CAP, FXD CER, 1000 PF +/-10%, 500V	357806	56289	C106B102G-102K	2		
C24	CAP, FXD CER, 1000 PF +/-10%, 500V	357806	56289	C106B102G-102K	REF		
C25	CAP, TA, 47 UF +/-20%, 20V	348516	56289	196D476X0020LA3	REF		
C26	CAP, MICA, 100 PF +/-5%, 500V	148494	72136	DM15F101J	1		
C30	CAP, MICA, 240 PF +/-5%, 500V	362863	72136	DM15F241J	1		
C31	CAP, TA, 47 UF +/-20%, 20V	348516	56289	196D476X0020LA3	REF		
C32	CAP, MICA, 39 PF +/-5%, 500V	148544	72136	DM15E390J	REF		
C33	CAP, MICA, 56 PF +/-5%, 500V	148528	72136	DM15F560J	REF		
C34	CAP, CER, 0.5 PF +/-5%, 500V	436790	72982	831-000-5380-519D	1		
CL1	DIODE, CURRENT LIMITER	348482	89536	348482	2		
CL3	DIODE, CURRENT LIMITER	348482	89536	348482	REF		
CR1	DIODE, SI, ULTRA FAST	381806	05277	1N3062	2		
CR2	DIODE, SI, ULTRA FAST	381806	05277	1N3062	REF		
CR3	DIODE, SI, SMALL SIGNAL (MATCHED SET)	348177	03508	DA2429	2	2	
CR4	DIODE, SI, SMALL SIGNAL	348177	03508	DA2429	REF		
CR6	DIODE, SI	203323	03508	1N4448	5	1	
CR9	DIODE, RECTIFIER, SI	347559	14099	3SM05	4	1	
CR10	DIODE, RECTIFIER, SI	347559	14099	3SM05	REF		
CR11	DIODE, RECTIFIER, SI	347559	14099	3SM05	REF		

Table 5-3. A1A1 Main PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
CR12	DIODE, RECTIFIER, SI	347559	14099	3SM05	REF		
CR13	DIODE, SI	343491	77638	1N4002	2	1	
CR14	DIODE, SI	343491	77638	1N4002	REF		
CR15	DIODE, SI	203323	03508	1N4448	REF		
CR16	DIODE, SI	203323	03508	1N4448	REF		
CR17	DIODE, SI	203323	03508	IN4448	REF		
CR18	DIODE, SI	203323	03508	IN4448	REF		
CR24	DIODE, RECT, SI	343491	77638	1N4002	2	1	
CR25	DIODE, RECT, SI	343491	77638	1N4002	REF		
F1	FUSE, SLO-BLO, 1/8 AMP	166488	71400	MDL1-8	1	5	
P1	PLUG, POWER, 3 PRONG	SELECT	REQD	FROM 3 ITEMS BELOW			
	CONTACT, VOLTAGE	338657	89536	338657	2		
	CONTACT, EARTH COMMON	338640	89536	338640	1		
	INSULATOR, LINE CONTACT	338624	89536	338624	1		
Q1	XSTR, SI, PNP	195974	04713	2N3906	1		
Q2	XSTR, SI, NPN	168716	07263	S19254	2	1	
Q3	XSTR, SI, NPN	168716	07263	S19254	REF		
Q6	XSTR, SI, PNP	288761	07933	RS2048	1	1	
Q7	XSTR, SI, NPN	218396	04713	2N3904	8	2	
Q8	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q9	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q10	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q11	XSTR, SI, PNP	340026	04713	MPS6563	4	1	
Q12	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q13	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q14	XSTR, SI, PNP	340026	04713	MPS6563	REF		
Q15	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q16	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q17	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q18	XSTR, SI, NPN	218396	04713	2N3904	REF		
Q20	XSTR, SI, NPN (SELECTED)	352138	89536	352138	1	1	
Q21	XSTR, SI, PNP (SELECTED)	352146	89536	352146	1	1	
Q22	XSTR, SI, NPN	330803	07263	MPS6560	2	1	
Q23	XSTR, SI, NPN	330803	07263	MPS6560	REF		
R1	RES, (MATCHED SET R1, R2, R3)	306407	89536	306407	1	1	3
R2	RES, (MATCHED SET R1, R2, R3)				REF		
R3	RES, (MATCHED SET R1, R2, R3)				REF		
R5	RES, COMP 1M +/-5%, 1/4W	182204	01121	CB1055	1		
R6	RES, CAR. DEP, 150K +/-5%, 1/4W	348938	80031	CR251-4-5P150K	3		
R7	RES, CAR. DEP, 150K +/-5%, 1/4W	348938	80031	CR251-4-5P150K	REF		

Table 5-3. A1A1 Main PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
R8	RES, CAR. DEP, 1K +/-5%, 1/4W	343426	80031	CR251-4-5P1K	1		
R9	RES, COMP, 10K +/-5%, 1/4W	148106	01121	CB1035	1		
R10	RES, CAR DEP, 3.9 K +/-5%, 1/4W	342600	80031	CR251-4-5P3K9T	4		
R11	RES, COMP, 10 M 1/4W	194944	01121	CB1065	1		
R12	RES, VAR, CER, 500 +/-10%, 1/2W	291120	71450	360S501A	1	1	
R13	RES, CAR. DEP, 750 +/-5%, 1/4W	441659	80031	CR251-4-5P750E	1		
R14	RES, CAR. DEP, 10 K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	2		
R15	RES, VAR, 50K +/-30%, 1/4W	358127	71450	X201503	1	1	
R16	RES, COMP, 82K +/-5%, 1/4W	188458	01121	CB8235	1		
R17	RES, CAR DEP, 1 +/-5%, 1/4W	357665	TOYO	R251005	1		
R18	RES, COMP, 470K +/-10%, 2W	110247	01121	HB4741	1		
R19	RES, CAR DEP, 560K +/-5%, 1/4W	342642	TOYO	R255645	1		
R20	RES, VAR 20K +/-10%, 1/2W	291609	71450	360S203A	1	1	
R21	RES, COMP, 22 +/-5%, 2W	352229	01121	HB2205	1		
R22	RES, COMP, 330 +/-5%, 1/4W	147967	01121	CB3315	1		
R23	RES, VAR, 100 +/-10%, 1/2W	285130	71450	360S101A	1	1	
R24	RES, COMP, 82 +/-5%, 1/4W	149484	01121	CB8205	1		
R25	RES, VAR, 1K +/-10%, 1/2W	285155	71450	360S102A	1	1	
R26	RES, CAR. DEP, 150K +/-5%, 1/4W	348938	80031	CR251-4-5P150K	REF		
R27	RES, CAR. DEP, 30K +/-5%, 1/4W	368753	80031	CR251-4-5P30K	1		
R32	RES, CAR. DEP, 10 K +/-5%, 1/4W	348839	80031	CR251-4-5P10K	REF		
R33	RES, CAR DEP, 3.9K +/-5%, 1/4W	342600	TOYO	R253R925	REF		
R34	RES, CAR DEP, 3.9K +/-5%, 1/4W	342600	TOYO	R253R925	REF		
R35	RES, MF, 9.975 K +/-0.1%, 1/8W	441329	89536	441329	1		
R36	RES, CAR. DEP, 1 M +/-5%, 1/4W	348987	80031	CR251-4-5P1M	1		
R39	RES, CAR DEP, 470 +/-5%, 1/4W	343434	TOYO	R254715	1		
R41	RES, CAR DEP, 3.9K +/-5%, 1/4W	342600	TOYO	R253R925	REF		
R42	RES, CAR DEP, 470K +/-5%, 1/4W	342634	TOYO	R254745	2		
R43	RES, CAR DEP, 470K +/-5%, 1/4W	342634	TOYO	R254745	REF		
R44	RES, WW, CURRENT SHUNT, 900	312611	89536	312611	1		
R45	RES, WW, CURRENT SHUNT, 90	352401	89536	352401	1		
R46	RES, WW, CURRENT SHUNT, 9	352419	89536	352419	1		
R47	RES, WW, CURRENT SHUNT, 1	352427	89536	352427	1		
R48	RES, WW, 0.1 +/-0.1%, 1/2W	345579	89536	345579	1	1	
R50	RES, MF, 499 +/-0.1%, 1/8W	343475	89536	343475	1		
R51	RES, MF, 4.53 K +/-0.1% 1/8W	343467	89536	343467	1		
R55	RES, VAR, CER, 50 +/-10%, 1W	285122	71450	360S500A	1	1	
R59	RES, (MATCHED SET)				1		2
R63	RES, COMP, 33 +/-5%, 1/4W	175034	01121	CB3305	1		
RT1	THERMISTOR	573816	89536	573816	1		
S1-S11	SWITCH ASSY (CONTAINS S1 THRU S11)	342915	89536	342915	1		

Table 5-3. A1A1 Main PCB Assembly (cont)

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
T1	XFMR, POWER				1		
	115/230V VAC	345637	89536	345637			
T2	XFMR, INVERTER	354191	89536	354191	1		
U1	IC, OP AMP, LF357BN	524033	89536	524033	1		
U2	IC, OP AMP(MATCHED SET)				1		2
U5	IC, TTL DECODER/DRIVER	340109	01295	SN7447AN	1	1	
U6	RES, NETWORK, RN-2	344077	89536	344077	1		
U7	RES, NETWORK, RN-1	344069	89536	344069	1		
VR1	DIODE, ZENER .4W, DO7	330829	07910	1N4571	1		
VR2	DIODE, ZENER 400 MW +/-5%	260695	07910	1N754	2		
VR3	DIODE, ZENER 400 MW +/-5%	260695	07910	1N754	REF		
VR4	DIODE, ZENER 400 MW, 15V	246033	07910	1N965A	1		
VR6	DIODE, ZENER (MATCHED SET)				1		1
XF1	FUSE, CLIP	284984	84613	3621-2	1		
XU3	SOCKET, IC, 16-PIN	351916	82305	14-40P	2		
XU4	SOCKET, IC, 16-PIN	351916	82305	14-40P	REF		

NOTES:

1 C14, C16, VR6, R56*, R57*, R58* AND U3* ARE A MATCHED SET. FOR RPLACEMENT ORDER J/F PART NO. 476226.

2 CR3, R53*, R54*, R59 AND U2 ARE A MATCHED SET. FOR REPLACEMENT ORDER J/F PART NO. 345504.

* SEE FINAL ASSEMBLY

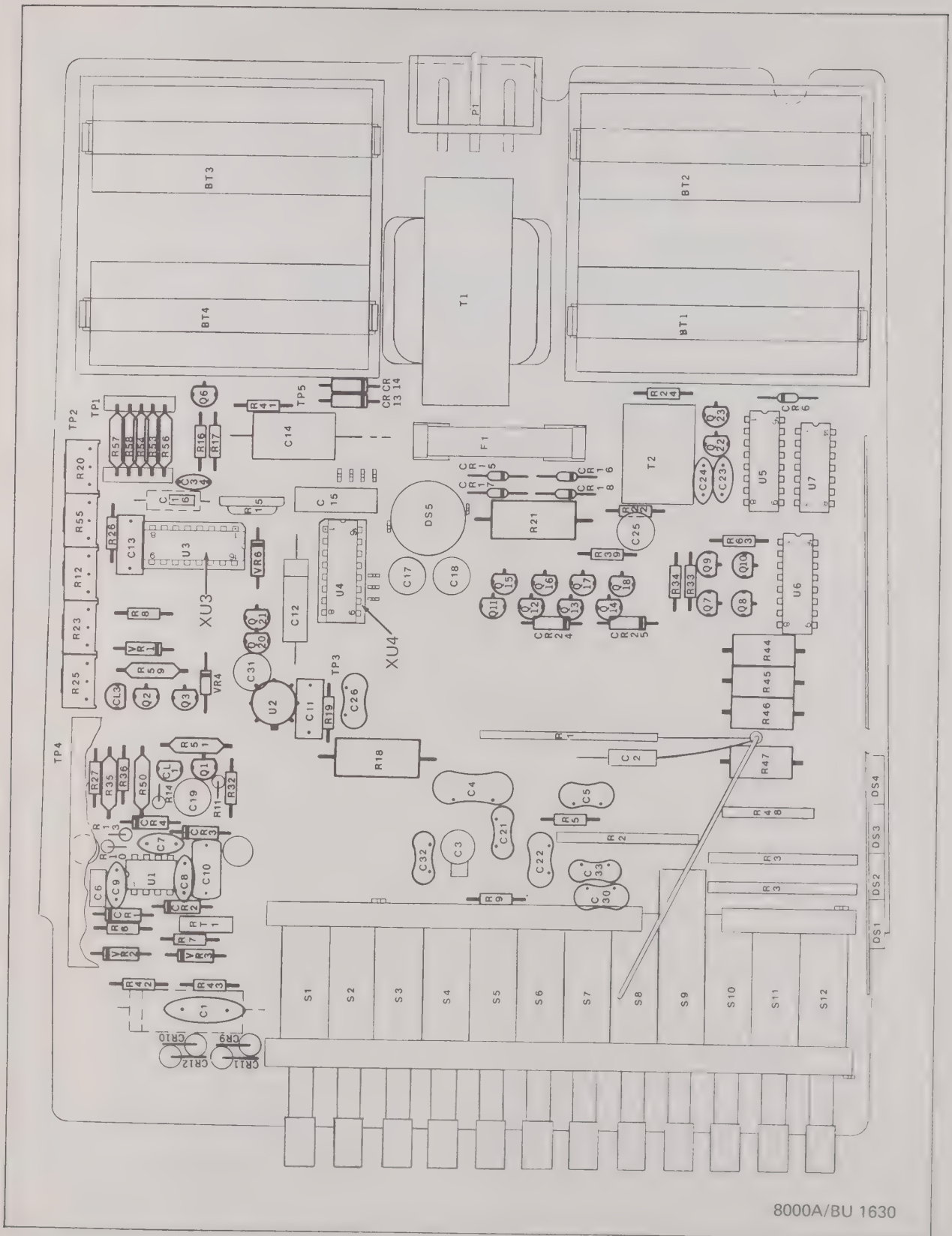


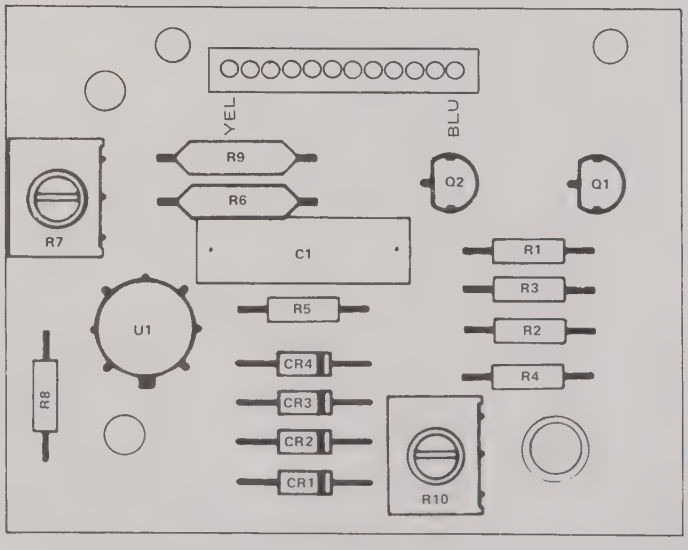
Figure 5-3. A1A1 Main PCB Assembly

Table 5-4. A1A2 Display PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1A2	DISPLAY PCB ASSEMBLY (8000A-4016) FIGURE 5-3 DETERMINE COLOR OF LIT SEGMENTS WITH RED LENS REMOVED; RED OR ORANGE. THEN ORDER REPLACEMENT TO MATCH	ORDER	NEXT HIGHER LEVEL		REF		
DS1	LED, +/- AND 1				1	1	
	RED	472951	89536	472951			
	ORANGE	418400	29083	Q3203			
DS2	LED, SEVEN-SEGMENT				3	1	
	RED	429985	89536	429985			
	ORANGE	418392	29083	Q3202			
DS3	LED, SEVEN-SEGMENT				REF		
	RED	429985	89536	429985	REF		
	ORANGE	418392	29083	Q3202	REF		
DS4	LED, SEVEN-SEGMENT				REF		
	RED	429985	89536	429985	REF		
	ORANGE	418392	29083	Q3202	REF		

Table 5-5. A1A3 Meter II Circuit PCB Assembly

REF DES	DESCRIPTION	FLUKE STOCK NO.	MFG SPLY CODE	MFG PART NO. OR TYPE	TOT QTY	REC QTY	NOTE
A1A3	METER II CIRCUIT PCB ASSY (8000A/BU-4015S) FIGURE 5-4		ORDER	NEXT HIGHER LEVEL		REF	
C1	CAP, MYLAR, 0.1 UF +/-10%, 50V	271866	06001	75F3R5A104	1		
CR1	DIODE, SI, LO-CAP, LO-LEAK	348177	07263	FD7223	4	1	
CR2	DIODE, SI, LO-CAP, LO-LEAK	348177	07263	FD7223	REF		
CR3	DIODE, SI, LO-CAP, LO-LEAK	348177	07263	FD7223	REF		
CR4	DIODE, SI, LO-CAP, LO-LEAK	348177	07263	FD7223	REF		
Q1	XSTR, SI, PNP	288761	01295	SKA6808	1	1	
Q2	XSTR, FET	288324	89536	288324	1	1	
R1	RES, DEP. CAR., 1.5K +/-5%, 1/4W	343418	80031	CR251-4-5P1KST	1		
R2	RES, COMP, 13K +/-5%, 1/4W	221598	01121	CB1335	1		
R3	RES, DEP. CAR., 100K +/-5%, 1/4W	348920	80031	CR251-4-5P100KT	1		
R4	RES, DEP, CAR., 1M +/-5%, 1/4W	348987	80031	CR251-4-5P1MT	1		
R5	RES, DEP. CAR., 10K +/-5%, 1/4W	348839	80031	CR251-4-5P10KT	1		
R6	RES, MTL, FILM, 174 +/-1%, 1/8W	343913	91637	CMF551740F	1		
R7	RES, VAR, 10K +/-10%, 1/2W	309674	89536	309674	1	1	
R8	RES, DEP. CAR., 4.7K +/-5%, 1/4W	348821	80031	CR251-4-5-P4K7T	1		
R9	RES, MTL. FILM, 7.87K +/-1%, 1/8W	294934	91637	CMF557871F	1		
R10	RES, VAR, 2K +/-10%, 1/2W	309666	89536	309666	1	1	
U1	IC, OP. AMP	310037	12040	LH0042CH	1	1	



8000A/BU-1615

Figure 5-4. A1A3 Meter II Circuit PCB Assembly

Section 6
Accessory Information

6-1. INTRODUCTION

6-2. This section of the manual contains information pertaining to the accessories available for your instrument. Each of the accessories are described under separate major headings containing the model or option number. The descriptions contain specificaitons for each accessory. Detailed information is supplied with each accessory.

6-3. CARRYING CASE (Y8205)

6-4. The Model Y8205 Carrying Case, Figure 6-1, is a soft vinyl plastic container, designated for the storage and transport of the 8000A/BU. The case provides the 8000A/BU with adequate protection against normal handling and storage conditions. A separate storage compartment is provided for test leads, power cord, and other compact accessories.

Figure 6-1. Model Y8205 Carrying Case

6-5. CARRYING CASE (C86)

6-6. The Model C86 Carrying Case, Figure 6-2, is a molded polyethylene container, with handle, designed for use in transporting the 8000A/BU. This rugged case provides the 8000A/BU with maximum protection against rough handling and adverse weather conditions. A separate storage compartment is provided for test leads, power cord, and other compact accessories.

Figure 6-2. Model C86 Carrying Case

6-7. FRONT PANEL DUST COVER (M00-100-714)

6-8. The front panel dust cover is a molded plastic snap-on accessory which fits over the front panel of the 8000A/BU. The dust cover provides protection for the front panel controls, and is useful when storing or transporting the 8000A/BU.

6-9. RACK MOUNTING KITS

6-10. Introduction

6-11. Three rack mounting kits are available for mounting the 8000A/BU in a standard 19-inch equipment rack. The kits, listed in Table 6-1, provide the option of either offset mounting (left/right), center mounting, or side-by-side mounting.

Table 6-1. Rack Mounting Kits

MOUNTING STYLE	MODEL NUMBER
Offset	M00-200-611
Center	M00-200-612
Side-By-Side	M00-200-613

6-12. Installation Procedure

6-13. Installation instructions for each of the rack mounting kits is given in the following paragraphs. Use the procedure which corresponds to the model number of the kit being installed.

6-14. OFFSET AND CENTER MOUNTING KITS (M00-200-611 and M00-200-612)

1. Remove 8000A/BU carrying handle by removing the handle disc decals and the handle mounting screws.

2. Remove screw from rear of case and separate the case from the 8000A/BU.

3. Install the side mounting brackets, as shown in Figure 6-3, and secure them to the mounting panel using the nuts provided.

4. Insert the front of the 8000A/BU case through the opening on the back side of the mounting panel.

5. Install the handle mounting screws through the side brackets into the handle mounting bosses. Don't over tighten these screws.

6. Slide the 8000A/BU through the mounting panel and into the case. Install and tighten the retaining screw at the rear of the case.

6-15. SIDE-BY-SIDE MOUNTING KIT (M00-200-613)

1. Remove the carrying handles from both 8000A/BUs by removing the handle disc decals and the handle mounting screws.

2. Remove the retaining screw from the rear of the cases and separate the instruments from their cases.

3. Install the center mounting bracket, as shown in Figure 6-4, and secure it to the mounting panel, using the nuts provided.

4. Install the clamp screw in the center mounting bracket, using the nuts and washers provided.

5. Insert the front of the 8000A/BU cases through the openings on the back side of the mounting panel. Make sure the case's handle mounting bosses are inserted into the clamp hole of the center mounting bracket.

6. Tighten the clamp screw.

7. Install the side mounting brackets and secure them to the front panel, using the nuts provided.

8. Install the handle mounting screws through the side brackets into the handle mounting bosses. Don't over tighten these screws.

9. Slide the 8000A/BUs through the mounting panel and into their cases. Install and tighten the retaining screw at the rear of both cases.

6-16. DELUXE TEST LEAD KIT (A80)

6-17. The deluxe test lead kit, shown in Figure 6-5, contains two test leads with probes (red and black), and five pairs of universal probe tips. The probe tips include: alligator clips, test prod tips, pin tips, banana plug tips, and binding post lugs. A convenient plastic pouch is provided for storing the contents of the test lead kit.

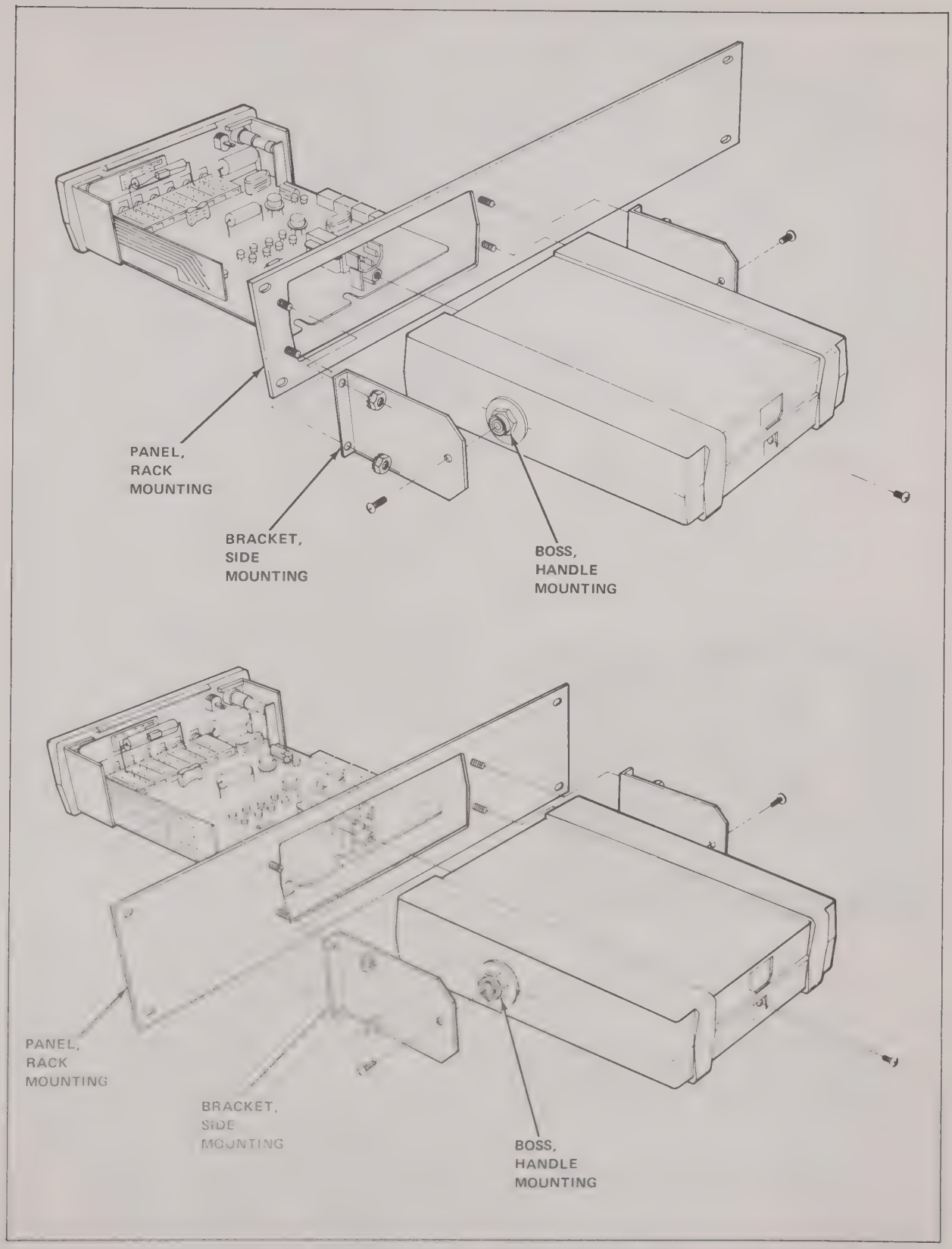


Figure 6-3. Rack Mounting Kits, Offset and Center Mounting

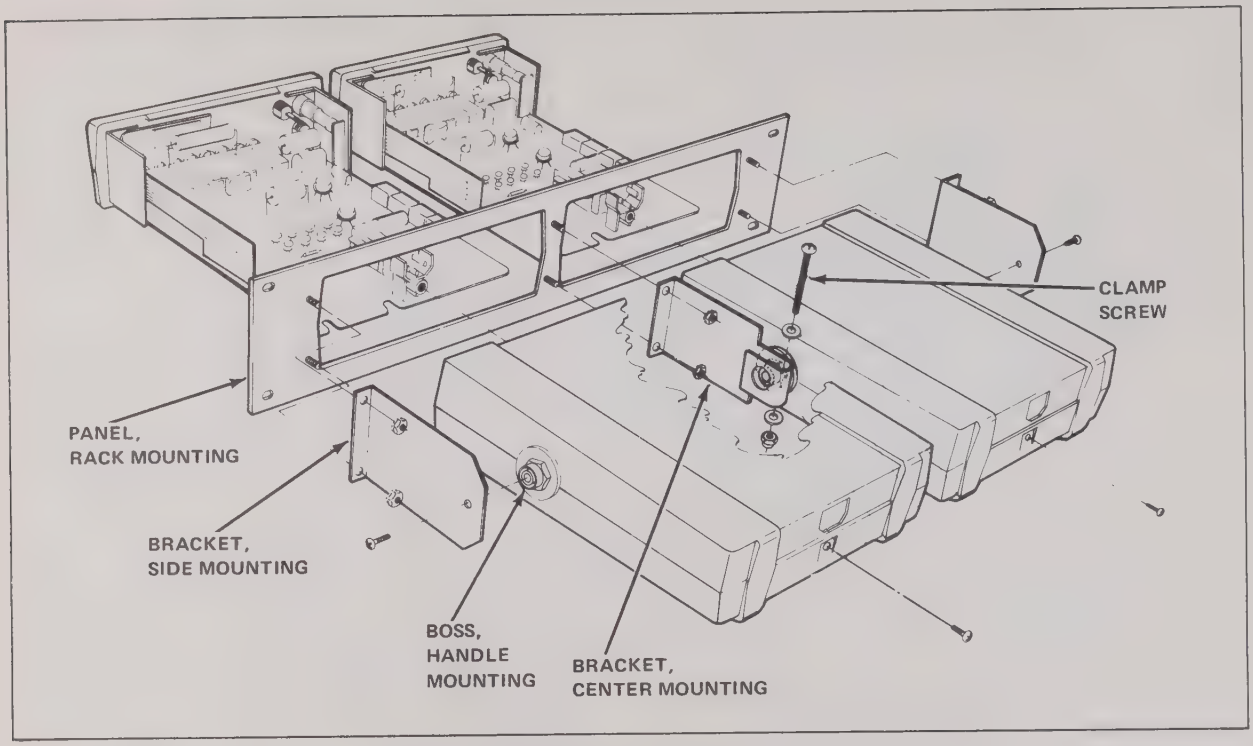


Figure 6-4. Rack Mounting Kit, Side-By-Side Mounting

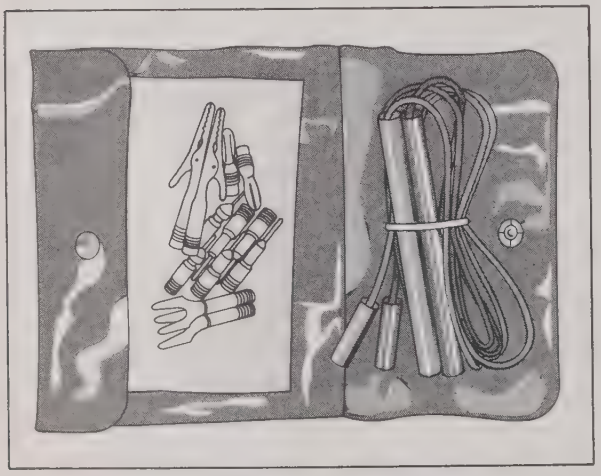


Figure 6-5. Deluxe Test Lead Kit (A80)

6-18. Y8140 TEST LEAD SET

6-19. The Model Y8140 Test Lead Set consists of two test leads with a retractable needle-point tip on each probe. Both tips are insulated up to their point and are flexible in the extended position. Details of the probe set are shown in Figure 6-6.

6-20. TEMPERATURE PROBE (80T-150)

6-21. Description

6-22. The 80T-150 Temperature Probe (Figure 6-6) converts the 8000A/BU into a direct-reading (1 mV dc/°) °C or °F thermometer. It is ideally suited for surface, ambient, and liquid measurements, and lends itself easily to a wide range of design, troubleshooting, and evaluation applications. A rugged, fast-responding probe-tip with a 350V dc standoff makes the 80T-150 one of the most versatile and easy-to-use temperature probes available.

6-23. Specifications

Range	-50°C to +150°C, -58°F to +302°F
Range Selection	Internal Jumpers
Sensitivity	1mV per °C or °F
Resolution	0.1°C or 0.1°F recommended maximum
Ambient Temperature Range	0°C to +50°C
Relative Humidity	<80% non-condensing
Accuracy	Including nominal +/-0.25% voltmeter error at +15°C to +35°C ambient. Add 1°C to the accuracy speicifcations if ambient temperature is below +15°C or above +35°C
-50°C to -25°C	+/-3°C
-25°C to +125°C	+/-2°C
+125°C to +150°C	+/-3°C
Voltmeter Input Impedance	>10 megohm

Maximum Voltage	Probe tip to circuit low, 350V dc or peak ac
Power	Internal disposable battery; 1000 hours of continuous use

6-24. Y8100 DC/AC CURRENT PROBE

6-25. Description

6-26. The Model Y8100, as shown in Figure 6-6, is a battery-powered clamp-on current probe for measuring currents up to 200A dc or ac rms. Two ranges are provided on the probe, 20A and 200A. The probe produces a dc output voltage proportional to the measured current. At full scale the output of the probe is 2V dc. Current carrying conductors up to 1.9 cm (0.75 inches) in diameter can be placed within the probe clamp.

6-27. Specifications

Full Range Output	2V dc
Accuracy (output)	
DC to 200 Hz	±2% of Range
200Hz to 1 kHz	<100A add ±3% of reading >100A add ±6% of reading
Frequency Response	dc to 1.0 kHz
Recommended Load	>3 kilohms
Temperature Range	
Operating	+5°C to +35°C
Storage and operation at reduced accuracy	−10°C to +50°C
Heating Limitation	Prolonged operation above 200A ac or 1 kHz can damage the probe.
Working Voltage Rating	Core to ouptut: 600V dc or 480V ac maximum. Output to ground: 42V dc or 30V ac maximum.

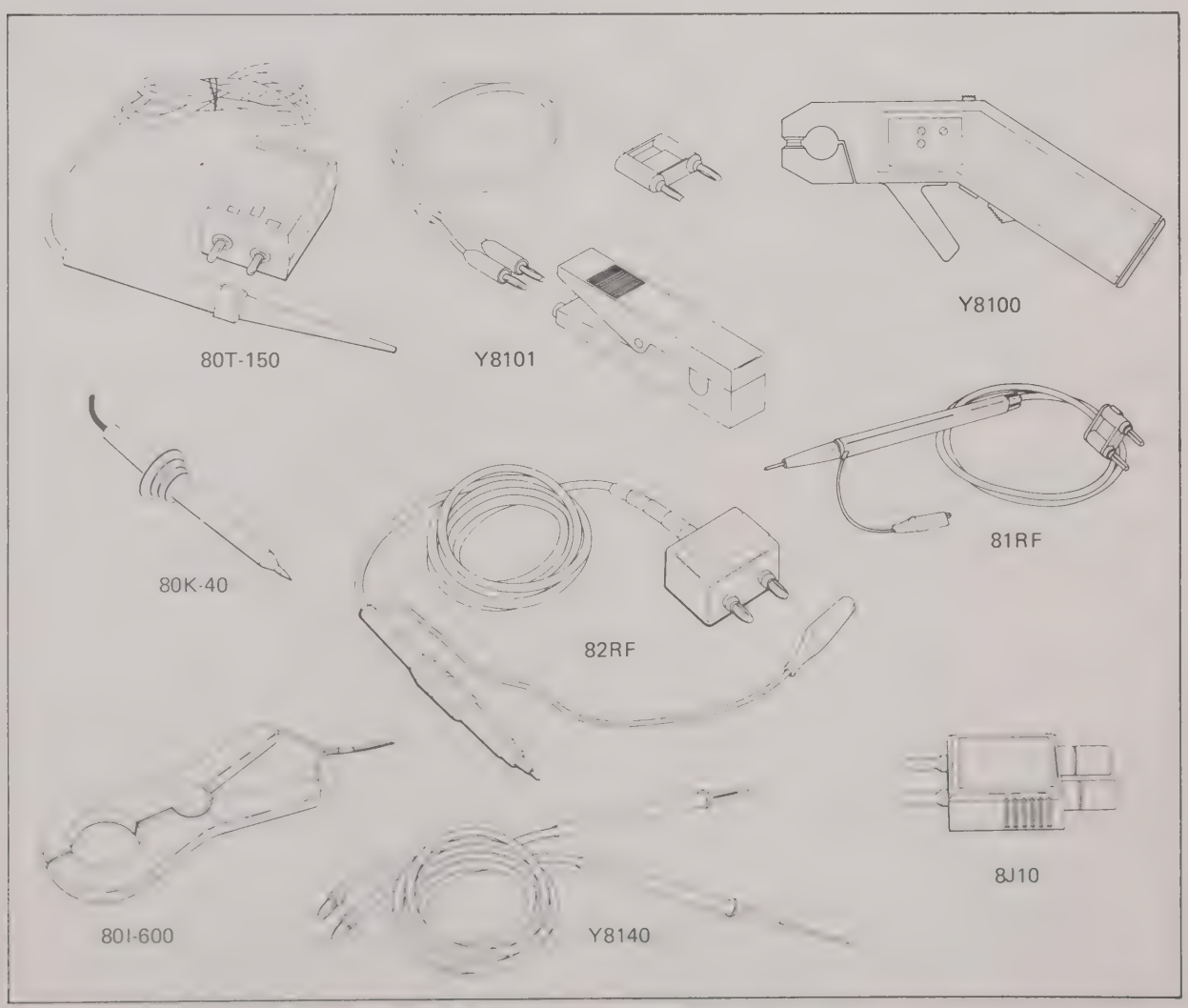


Figure 6-6. 8000A/BU Probes and Transformers

6-28. CURRENT TRANSFORMER (Y8101)

6-29. Description

6-30. The Model Y8101 (Figure 6-6) is a small clamp-on current transformer designed to extend the current measuring capability of an ac current meter up to 150 amperes. A clamp-on coil designed into the probe allows measurements to be made without breaking the circuit under test. This coil serves as the secondary of a 1:1000 transformer. The current-carrying conductor being measured serves as the primary.

6-31. Specifications

Range	2A to 150A
Accuracy	(48 Hz to 10 kHz): ±2%, 10A to 150A ±8%, 2A to 10A
Division Ratio	1000:1
Working Vovtage	300V ac rms max.
Insulation	3 kV
Maximum Conductor Size	2-inch diameter

6-32. CURRENT TRANSFORMER (80I-600)

6-33. Description

6-34. The Model 80I-600 (Figure 6-6) extends the maximum 2A ac current measuring capability of the 8000A/BU up to a maximum of 600 amps. A clamp-on transformer designed into the probe allows measurements to be made without breaking the circuit under test. In use, the current-carrying conductor being measured serves as the transformer's primary while the 80I-600 serves as the secondary. Because of a high efficiency, quadrature-type of winding, wire size and location of the conductor within the transformer jaws do not affect accuracy of the current measurement.

6-35. Specifications

Range	1 to 600A ac
Accuracy	±3%
Frequency Range	30 Hz to 1 kHz
Division Ratio	1000:1
Insulation	5 kV
Maximum Conductor Size	2-inch diameter

6-36. 80J-10 CURRENT SHUNT

6-37. Description

6-38. The Model 80J-10 is a plug-in shunt designed to convert a voltmeter into a current meter. Two banana plugs, see Figure 6-6, with 0.75-inch spacing are used to connect the shunt to the input terminals of the voltmeter. Input connections to the shunt are made at two 5-way binding posts. The shunt value is selected to provide a 10 mV per ampere output.

6-39. Specifications

Sensitivity	10 mV per ampere
Shunt Resistance	0.01 ohms
Accuracy	±0.25% from dc to 10 kHz, rising 1 dB at 100 kHz
Series Inductance	8.3 nh
Overload	>20A, not fused

6-40. HIGH VOLTAGE PROBE (80K-40)

6-41. Introduction

6-42. The Model 80K-40 (Figure 6-6) extends the voltage measurement capability of the 8000A/BU up to 40 kV. Internally, the probe contains a special 1000:1 resistive divider. Metal-film resistors with matched temperature coefficients comprise the divider, and provide the probe with its excellent accuracy and stability characteristics. Also, an unusually high input impedance (1000 MΩ) minimizes circuit loading, and thereby contributes to measurement accuracy.

6-43. Specifications

Voltage Range	1 kV to 40 kV dc or peak ac, 28 kV rms ac.
Input Resistance	1000 MΩ
Division Ratio	1000:1
Accuracy	
DC	
1 kV to 20 kV	Linear change from +/−4% to +/−2%
20 kV to 30 kV	+/−2% (calibrated to 1% at 25 kV)
30 kV to 40 kV	Linear change from +/−2% to +/−4%
AC	+/−5% at 60 Hz

6-44. HIGH FREQUENCY PROBE (81RF)

6-45. Introduction

6-46. The 81RF probe (Figure 6-6) extends the frequency range of the 8000A/BU's voltage measurements capability to include 100 kHz to 100 MHz inputs from 0.25 to 30V rms. It operates in conjunction with the 8000A/BU dc voltage ranges, and provides a dc output that is calibrated to be equivalent to the rms value of a sinewave input.

6-47. Specifications

AC-to-DC Transfer Ratio

RMS Input (100 kHz)	DC Output
0.25 to 0.5V	0.25 to 0.5V +/−1.5 dB
0.5 to 2.0V	0.5 to 2.0V +/−0.5 dB
2.0 to 30V	2.0 to 30V +/−1.0 dB

Frequency Response . . . . . ±1 dB from 100 kHz to 100 MHz

Extended Frequency Response . . . . . Useful for relative readings from 20 kHz to 250 MHz.

Response . . . . . Responds to peak value of input; calibrated to read rms value of a sinewave.

Voltage Range . . . 0.25 to 30V rms

Maximum DC Input . . . . 350V dc

Input Impedance . . . 12 MΩ shunted by 15 pF

6-48. HIGH FREQUENCY PROBE (82RF)

6-49. Introduction

6-50. The Model 82RF High Frequency Probe, Figure 6-6, allows measurements over a frequency range of 100 kHz to 500 MHz from 0.25 to 30V rms. It is designed to be used with voltmeters having an input impedance of 10 megohms ± 10%. It may be used with a voltmeter having an input impedance higher than 10 megohms provided the input is externally shunted to make the equivalent input impedance equal to 10 megohms.

6-51. Circuitry within the 82RF consists of a capacitor-coupled rectifier circuit which responds to the peak value of the input waveform. The output is positive pollarity dc which is calibrated to be equivalent to the rms value of a sinewave.

6-52. Specifications

Frequency Response . . . . . 3 dB from 100 kHz to 500 MHz

Extended Frequency Response . . . . . Useful for relative readings from 20 kHz to 700 MHz.

Response . . . . . Responds to peak value of input; calibrated to read rms value of a sinewave

Voltage Range . . . 0.25 to 30V rms

Maximum DC Input . . . . 200V dc

Input Impedance . . . 2 MΩ shunted by 4 pF

6-53. GENERAL PURPOSE ACCESSORIES

6-54. Several other general purpose accessories; such as adapters, connectors, and attenuators are available. These are listed and described in Table 6-2.

Table 6-2. General Purpose Accessories

MODEL NO.	DESCRIPTION	MODEL NO.	DESCRIPTION
Y9104	Alligator Clip to fit pin tip	Y9112	6-Foot BNC Cable (1.95m)
Y9105	Alligator Clip to fit banana plug	Y9113	BNC Plug-to-Dual Banana Plug
Y9108	BNC Jack-to-Dual Banana Plug	Y9118	¼" Phone Jack-to-Dual Banana Plug
Y9111	3-Foot BNC Cable (97 cm)	Y9119	Phone Jack-to-Dual Banana Plug

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the List of Replaceable Parts contained in Section 5. The following information is presented in this section:

List of Abbreviations

Federal Supply Codes for Manufacturers

Fluke Technical Service Centers - U.S. and Canada

Fluke Technical Service Centers - International

Sales Representatives - U.S. and Canada

Sales Representatives - International

List of Abbreviations and Symbols

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
°C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
°F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^9)
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^3)
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^6)
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(-) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmablle read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
semo	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Federal Supply Codes for Manufacturers

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisburg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884
Use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571
Use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
The Ross Milton Co.
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Div.
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, Massachusetts

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933
Use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

Federal Supply Codes for Manufacturers (cont)

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988
Use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, Minnesota

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

11711
General Instrument Corp.
Rectifier Division
Hicksville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Div.
AMF Canada LTD.
Guelph, Ontario, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
The Budd Co. Polychem Products
Plastic Products Div.
Bridgeport, Pennsylvania

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606
Use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors,
formerly Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics
Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
GTE Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

Federal Supply Codes for Manufacturers (cont)

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Bucheye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co.
Corporate HQ
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
AB Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical
Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

34333
Silicon General
Westminister California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
P.R. Mallory & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp. formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, California

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnback Radio Co., Inc.
Freeport, New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village
Chicago, Illinois

72005
Wilber B. Driver Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

Federal Supply Codes for Manufacturers (cont)

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Bechman Instrument Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrance, California

73445
Amperex Electronic Corp.
Hicksville, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp.
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp.
Mepco Div.
A North American Phillips Co.
Norristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183
Use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Arnold Stevens, Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81483
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
The Carr Co., United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Div.
Eatontown, New Jersey

83330
Herman H. Smith, Inc.
Brooklyn, New York

83478
Rubbercraft Corp.
of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
John Fluke Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

Federal Supply Codes for Manufacturers (cont)

90201
Mallory Capacitor Co.
Div. of P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211
Use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737
Use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div. of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154
Use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts, Div. of
Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic
Hardware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect.
Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779
Use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

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Appendix 7A

Manual Change Information

INTRODUCTION

This appendix contains information necessary to backdate the manual to conform with earlier pcb configurations. To identify the configuration of the pcb's used in your instrument, refer to the revision letter (marked in ink) on the component side of each pcb assembly. Table 7A-1 defines the assembly revision levels documented in this manual.

NEWER INSTRUMENTS

As changes and improvements are made to the instrument, they are identified by incrementing the revision letter marked on the affected pcb assembly. These changes are documented on a supplemental change/errata sheet which, when applicable, is inserted at the front of the manual.

OLDER INSTRUMENTS

To backdate this manaul to conform with earlier assembly revision levels, perform the changes indicated in Table 7A-1.

CHANGES

There are no backdating changes at this printing. All pcb assemblies are documented at their original revision level.

Table 7A-1. Manual Status and Backdating Information

Ref Or Option No.	Assembly Name	Fluke Part No.	* To adapt manual to earlier rev configurations perform changes in desending order (by no.), ending with change under desired rev letter																						
			–	A	B	C	D	E	F	G	H	J	K	L	M	N	P								
A1A1	Main PCB Assembly	–	X																						
A1A2	Display PCB Assembly	387738	●	X																					
A1A3	Meter II Circuit PCB Assembly	581652	●	X																					

* X = The PCB revision levels documented in this manual.
● = These revision letters were never used in the instrument.
– = No revision letter on the PCB.

Section 8
Schematic Diagrams

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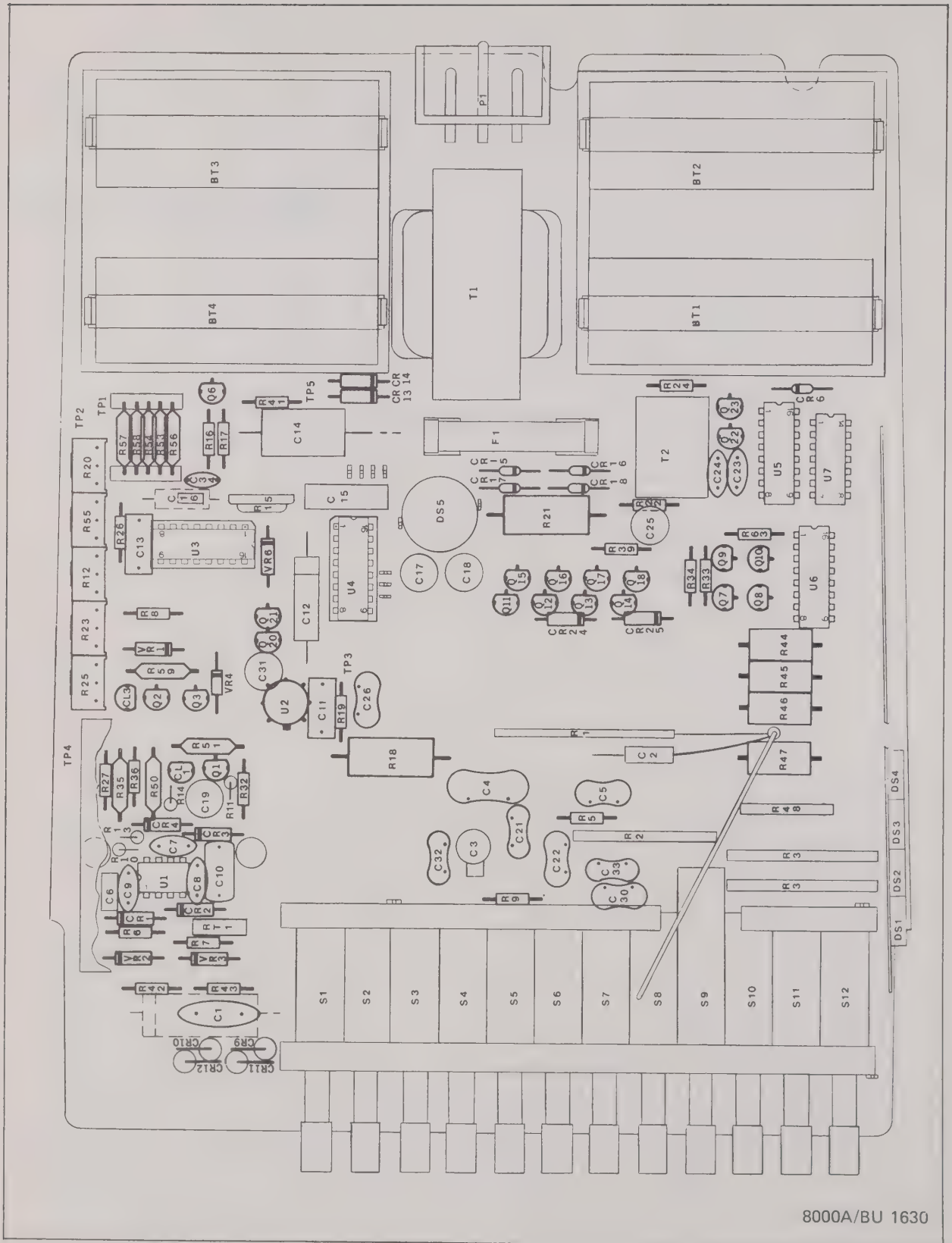
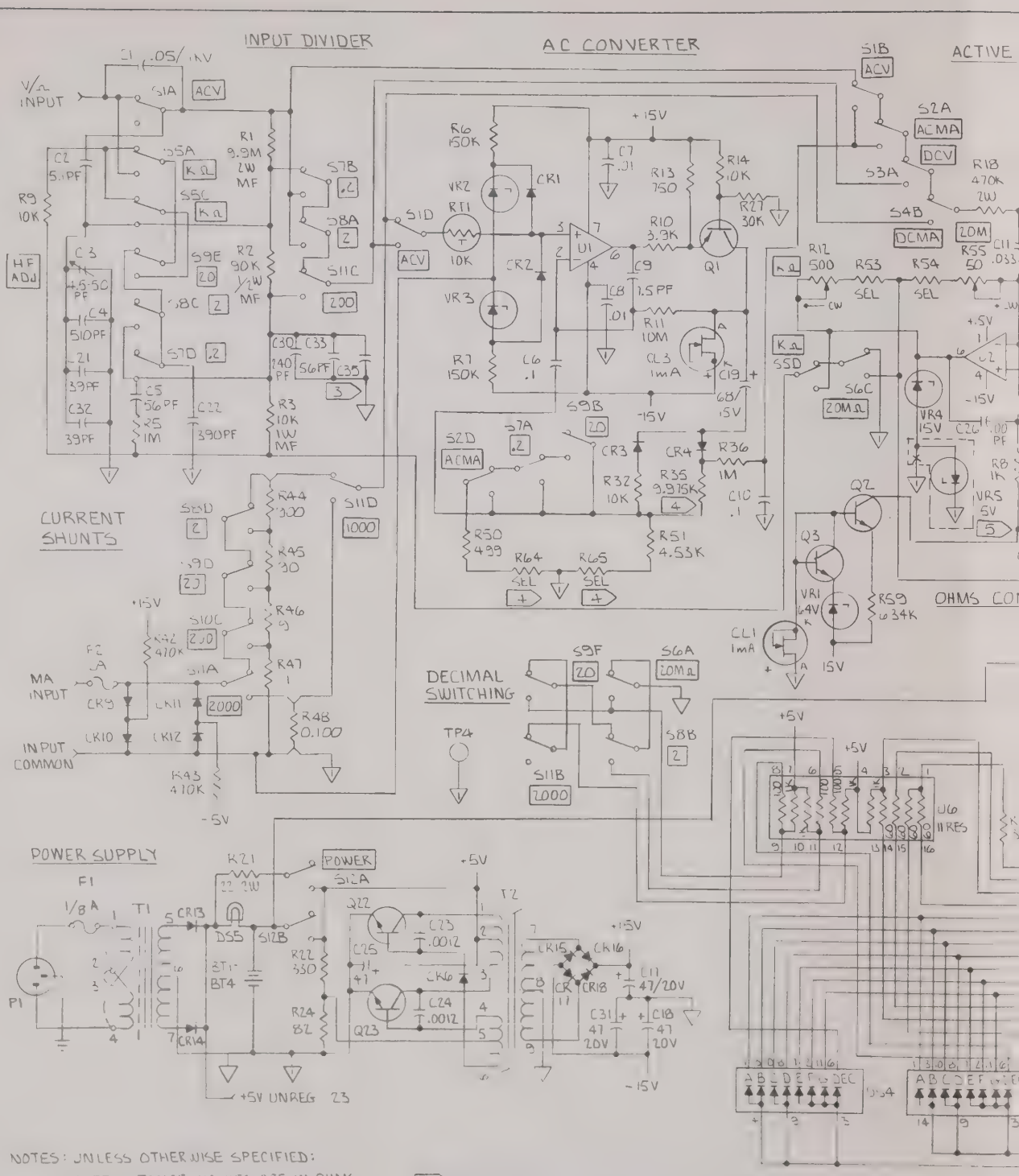


Figure 8-1. A1A1 Main PCB and A1A2 Display PCB Assemblies



NOTES: UNLESS OTHERWISE SPECIFIED:

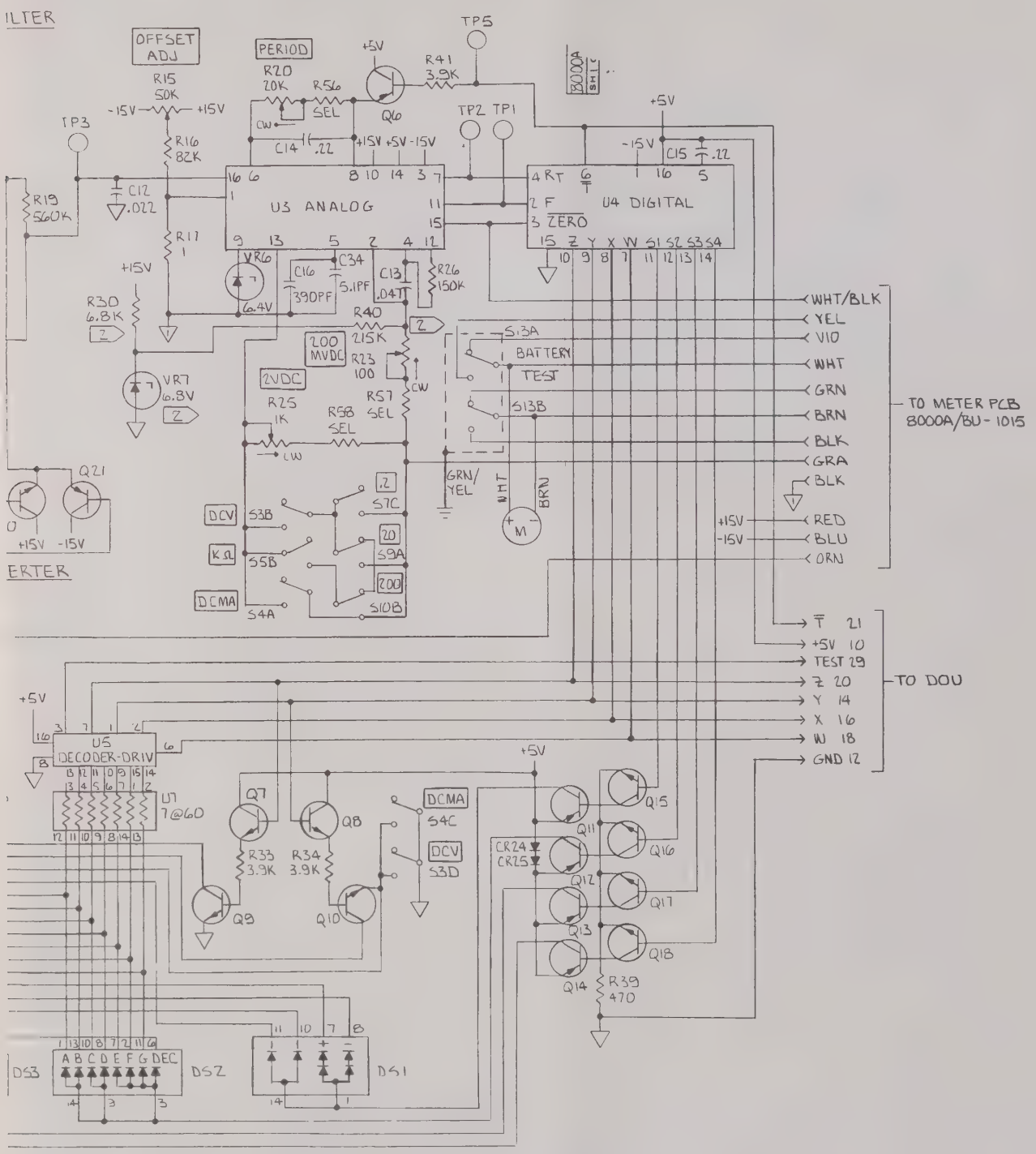
1. ALL RESISTANCE VALUES ARE IN OHMS; ALL CAPACITANCE VALUES IN MICROFARADS.

2. R30, R40 & VR7 INSTALLED IN TEST IF REQ'D FOR NEGATIVE TURNOVER.

3. C33 VALUE MAY BE CHANGED OR C35 MAY BE ADDED IN TEST IF REQ'D.

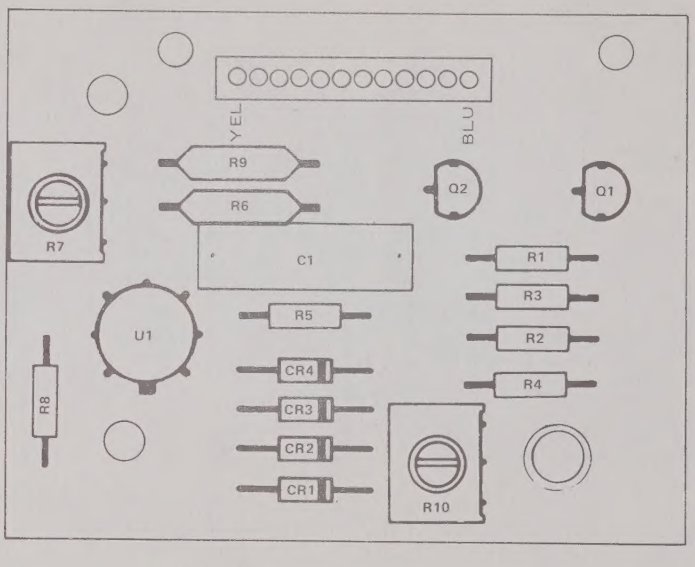
4. R64 AND OR R65 MAY BE SELECTED AND ADDED IN TEST IF REQ'D. R35 VALUE MAY BE CHANGED IN TEST IF REQ'D.

5. VR7 INSTALLED IN TEST IF REQ'D FOR PROPER FUNCTIONING FOR U2.



8000A/BU-1030

Figure 8-1. A1A1 Main PCB and A1A2 Display PCB Assemblies (cont)



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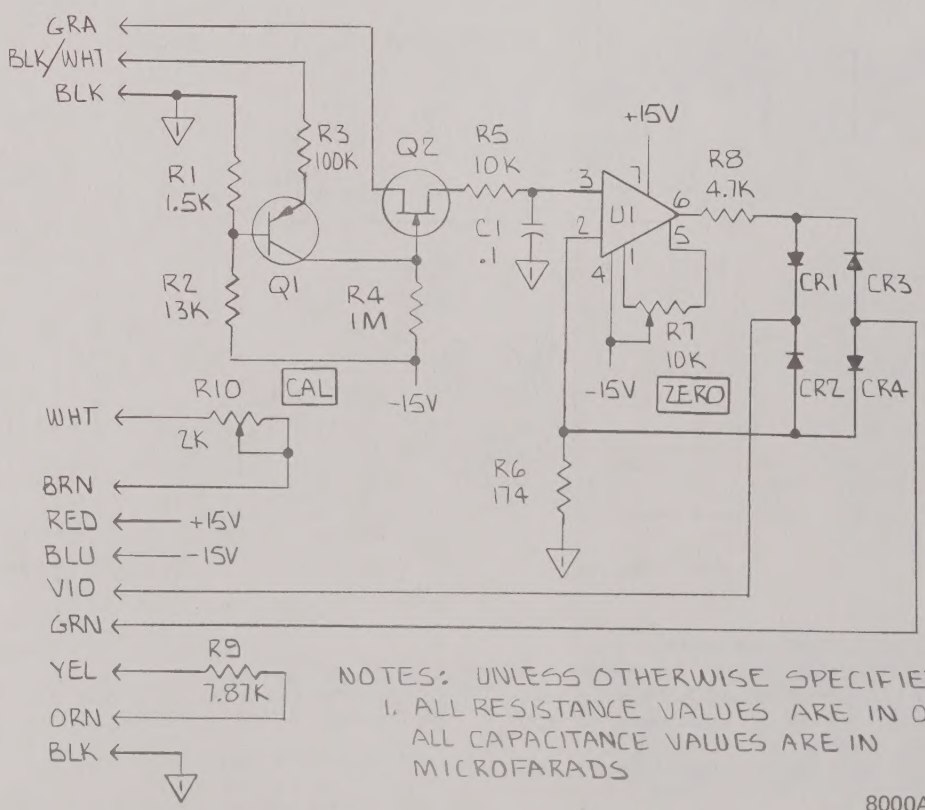

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Figure 8-2. A1A3 Meter II Circuit PCB Assembly

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